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B.C. Agriculture, Dep't.

(DEPARTMENT OF AGRICULTURE.)

INSECT PESTS AND PLANT DISEASES

CONTAINING

REMEDIES AND SUGGESTIONS

RECOMMENDED FOR ADOPTION BY

FARMERS, FRUIT-GROWERS, AND GARDENERS OF THE PROVINCE.

PREPARED UNDER THE SUPERVISION AND AUTHORITY OF THE

PROVINCIAL BOARD OF HORTICULTURE.

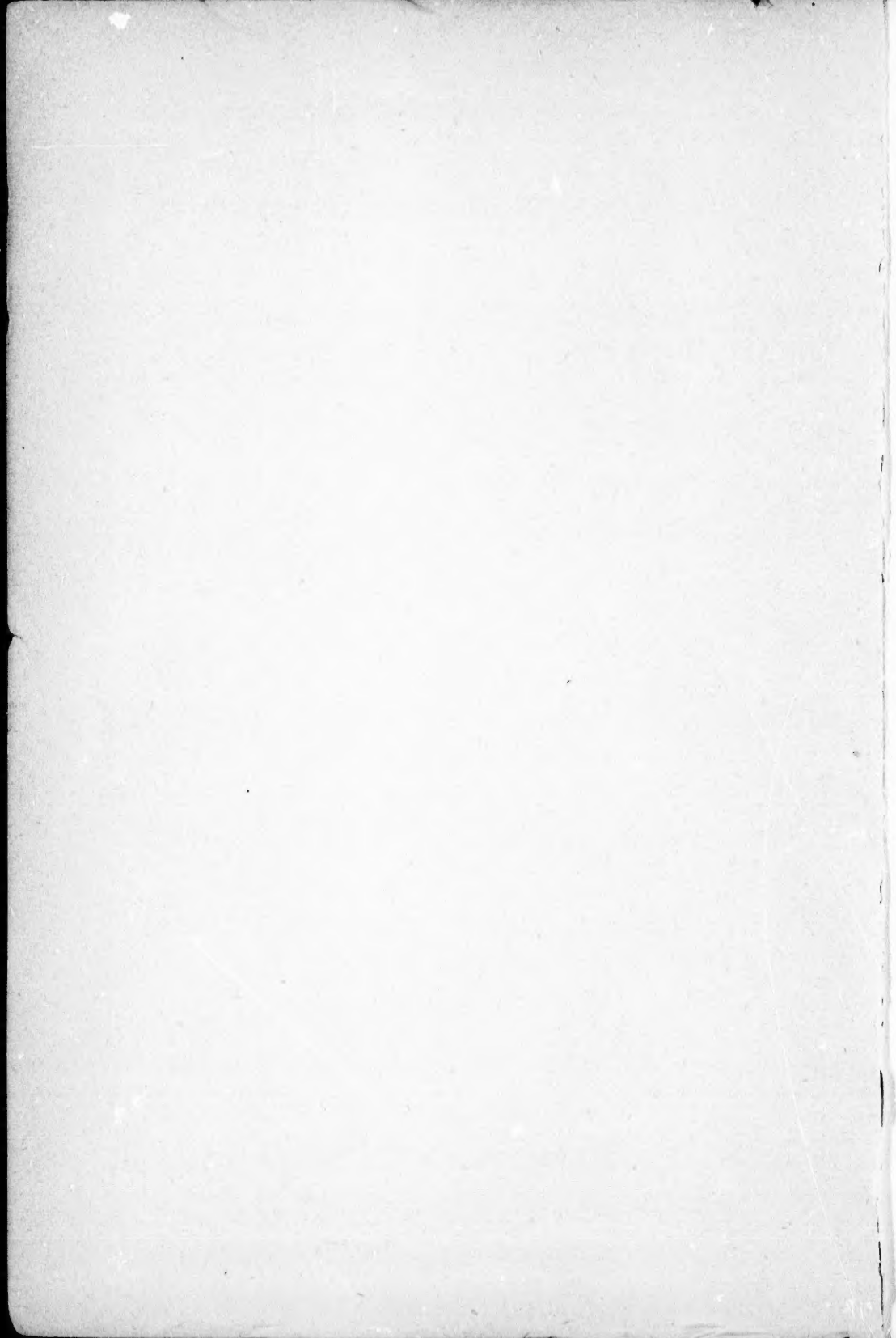


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VICTORIA, B. C.

Printed by RICHARD WOLFRENDEN, Printer to the Queen's Most Excellent Majesty
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PREVENTION OF INSECT PESTS AND DISEASES.

The following pages have been prepared by direction of the Hon. the Minister of Agriculture for the use of, and distribution among, farmers and fruit-growers of British Columbia. The remedies and suggestions contained therein, which have been compiled under the careful supervision of the Provincial Board of Horticulture, are recommended to their careful consideration and for adoption. If generally acted upon they will, it is confidently asserted, prove to be effective, not only in preventing the spread of the insect pests and plant diseases which have made such inroads on the gardens and orchards of the Province, but in a large measure obtaining immunity. A condition precedent is that eternal vigilance must be exercised, and the success of whatever precautions may be adopted is dependent upon the thoroughness with which they are observed. The recommendations which are contained in these pages are the result of careful study of all the conditions, and are confirmed by experience.

The rapid spread of numerous destructive pests and hurtful plant diseases, following upon increased cultivation and the importations of fruits and nursery stock, has been seriously felt throughout the agricultural districts, and points to the necessity of a vigorous and rigid enforcement of the rules and regulations of the Department and the adoption of practical measures of suppression, in order that the promising agricultural resources of British Columbia may be permitted to develop.

Mr. R. M. Palmer, Inspector of Fruit Pests, in his report to the Hon. the Minister of Agriculture for the year ending December 31st, 1896, speaking with reference to his work in visiting and inspecting orchards in the different sections of the Province, says:—

“The necessity of this work has been emphasized by the discovery of the most dangerous scale insect enemy of fruit trees known—the San Jose Scale (*Aspidiotus Perniciosus*)—in two orchards on Vancouver Island, and although, so far as known, this pest has not spread, it is hardly possible that the infestation is limited to these cases. I propose during the coming season to give special attention to the district in which the infested trees were found.

“It has cost the fruit-growers of California and Oregon hundreds of thousands of dollars to fight the San Jose Scale, and the war against it still continues. Now it is known that this pest will live under the conditions obtained in British Columbia (which has been considered doubtful by some persons), there is no doubt that the most stringent measures should be adopted in dealing with it when found. The appearance of San Jose Scale in orchards and gardens in Ontario, and some of the Eastern and Southern States, has created wide-spread consternation amongst fruit-growers there, and a demand for Legislative assistance from the respective governments in dealing with the pest, similar to that enacted in the Pacific Coast States and British Columbia, has sprung up.

“In many parts of the lower mainland, and to a less extent on the islands, much injury has been done to the apple crop by a pest which has been named the Apple-Fruit-Miner. It is a small larva or “worm” which feeds upon the pulp of the fruit. To a slight extent, it had been noticed in previous seasons, but the past year it has been so plentiful as to destroy or render of no value a large percentage of the apple crop in some localities.

“In regard to the spraying of orchards, although good work has been done by many persons, and most encouraging reports are constantly being received of the good effects consequent on spraying, still there is much room for improvement. Many owners of orchards and gardens containing fruit trees are careless or indifferent; this is especially the case with old orchards in or near the cities. Most of these old orchards would better be destroyed altogether, as many of the trees, from various causes, such as neglect or being of poor or unsuitable varieties, are of no value to their owners, besides being infested with various insect pests and diseases, for which they serve as breeding places, and are a constant menace to the progressive fruit-growers. Those who spray and take care of their trees are demanding that more vigorous measures be taken to enforce the cleansing of these old, infected trees. Another year’s experience with the No. 1 spraying mixture (lime,

Introductory Remarks.

The San Jose Scale.

Importance of Spraying.

salt and sulphur) has added further evidence of its value as a winter wash for all kinds of fruit trees and bushes, and I might say, that this only corroborates the opinion of leading fruit-growers in the States to the south of this Province.

"It is generally noted that so much improvement results from its use in the health and vigour of the trees to which it is applied, as alone to justify the cost of the work.

"In some localities good work has been noted as being done by predaceous insects preying upon those injurious to plant life—the larva of *Syrphus* flies and Lady-bird beetles being very active during the warmer months in the destruction of aphides, and proving of great assistance in holding these pests in check. It will not, however, do to rely on this help to the neglect of spraying, as in the fall months the beneficial insects cease to work, and in a short time the aphides are generally to be found again continuing their species.

**Beneficial
Insects.**

"Experiments made with the Leggett Powder Gun, for the distribution of insecticides in the form of powder, demonstrate that the machine is of service in dealing with such pests as the gooseberry or currant worm, and the cherry and pear slug, saving much time and material.

"My sincere thanks are due to Dr. Fletcher, Dominion Entomologist, for assistance kindly and promptly given in the naming of specimens of insects and help in carrying on my work.

**Assistance
Acknowledged.**

Also to Mr. E. A. Carew-Gibson, who is making a special study of economic entomology for the Department of Agriculture, and, by collecting and observing specimens of insects through their different stages of existence, has rendered valuable assistance.

"As in previous years, the press of the Province have been kind enough to insert in their issues, at appropriate seasons, items furnished them in regard to the spraying of fruit trees, thus reminding fruit-growers of their duties in this respect—when most necessary. In the following pages I have compiled information from reliable sources and personal experience as to the best methods of contending against insect attacks and diseases of fruit trees, plants, etc., outlining the life history of the most important pests and diseases occurring in the Province, and giving formulas and directions for preparing the different spraying mixtures, which I trust will prove useful."

There is probably no one general method by which the farmer or fruit-grower can do more to protect his crops from insect injury than by "clean culture." A large proportion of injurious insects pass the winter under rubbish of many sorts, and the burning of this will destroy them.

It is a safe rule, whenever a crop is gathered, to clear off the remnants and destroy them as completely as possible. In orchards this recommendation is of special value. In dead

**A Safe Rule to
follow.**

wood on the trees, or on the ground, many species hide or complete their development during the winter. Every dead branch or twig should be cut, and with other rubbish taken out and burned. Loose bark is of little or no value to a tree, while it affords shelter to many hibernating species. Never leave an old wood-pile near an orchard. Many insects breed preferably in dead wood, but when it becomes too dry or rotten, they have a sharp instinct that enables them to discover a weak or sickly tree, and this they may attack and ruin, where otherwise it might recover. Fallen or diseased fruit should always be destroyed or fed to hogs.

Field and orchard should contain, as nearly as possible, nothing save the crop, and certainly neither rubbish nor remnants.

For field crops, a thorough system of crop rotation prevents the multiplication of many insect pests and plant diseases. It is a well established general rule that plants or trees are better able to resist insect attack when in a thrifty growing condition than when weak in vitality; consequently, such fertilisation as will bring about the healthiest growth is desirable.

It has long been observed that some varieties of fruits, vegetables and grains are more subject to insect attacks than others. Consequently, other things being equal, it is advisable to select such varieties for planting. Of mechanical methods, the simplest

**Various methods
employed.**

way of dealing with many insects, is to pick them off by hand; in the garden and home grounds, caterpillars of most kinds may be easily dealt with so, or their nests destroyed, in the case of those having such.

In the great majority of cases, the most effective methods of preventing insect injuries lies in the intelligent application of insecticides, or insect killing substances. These may be broadly divided into two classes:—(1) internal poisons, or those which take effect by being eaten with the ordinary food of the insect; and (2) external irritants, or those which act from

the outside—closing the breathing pores, or causing death by irritation of the skin. Besides these, however, various substances are used in preventing insect attacks, keeping the pests away because of offensive odours, or acting as mechanical barriers against them.

These are dealt with in the following ways:—

SPRAYING MIXTURES.

No. 1.—Winter Spray for Woolly Aphis, Scale Insects, and Pear Leaf Blister Mite; the ingredients of which are as follows:—

Lime, unslacked	30 lbs.
Sulphur, powdered	20 "
Salt, coarse	15 "
Water	60 gals.

Place 10 pounds of lime and 20 pounds of sulphur in a boiler with 20 gallons of water, and boil over a brisk fire for two hours, until the sulphur is thoroughly dissolved. It will then be amber-coloured. Next place 20 pounds of lime in a cask and pour water

Directions for use.

enough over it to thoroughly slack it. Add the salt. When dissolved, add to the lime and sulphur and boil half an hour longer. Add enough water to

make 60 gallons. Apply lukewarm.

Spray when the trees are dormant, or as soon as the leaves fall, and again in the spring before the buds swell. A good force-pump should be used, and care must be taken to thoroughly cover the infected trees with the mixture, which should be constantly stirred when applying.

To ensure freedom from lumps it is advisable to pass the mixture through a wire sieve or strainer. Nozzles which are self-cleaning and adjustable, such as the "Improved Bean" and "Bordeaux," are best adapted for distributing this and other spraying mixtures which contain a considerable amount of solid matter.

No. 2.—Summer Spray for Aphis; ingredients:—

Quassia chips	8 lbs.
Whale oil soap	7 "
Water	100 gals.

Boil the quassia chips in about eight gallons of water for one hour. Dissolve the soap in hot water, strain and mix both solutions together, and dilute with sufficient water to make 100 gallons altogether. To be used with a spray pump with as much force

Directions.

as possible in applying. This mixture is the standard remedy for hop-aphis, and has given most satisfactory results against other form of aphides, with

no injury to the foliage of trees treated.

No. 4.—Bordeaux Mixture for Apple-scab and all Fungous Diseases; ingredients:—

Sulphate of copper (bluestone)	4 lbs.
Unslacked lime	4 "
Water	50 gals.

It has been found that the method of combining the ingredients has an important bearing on both the chemical composition and physical structure of the mixture. For example, if the copper sulphate is dissolved in a small quantity of water and the lime milk diluted to a limited extent only, there results, when these materials are brought together, a thick mixture, having strikingly different characters from one made by pouring together weak solutions of lime and copper sulphate. It is true, furthermore, that if the copper sulphate solution and lime milk are poured together while the latter or both are warm, different effects are obtained than if both solutions are cool at the moment of mixing.

Briefly, the best results have been obtained from the use of the Bordeaux mixture made in accordance with the following directions: In a barrel or other suitable vessel place 25 gallons of water. Weigh out 4 pounds of copper sulphate, then tie the same in a piece of coarse gunny-sack and suspend it just beneath the surface of the water. By tying the bag to a stick laid across the top of the barrel, no further attention will be required. In another vessel slack 4 pounds of lime, using care in order to obtain a smooth paste, free from grit and small lumps. To accomplish this it is best to place the lime in an ordinary water pail and add only a small quantity of water at first, say a quart or a quart and a half. When the lime begins to crack and crumble and the water to disappear, add another quart or more, exercising care that the lime at no time gets too dry. Toward the last considerable water will be required, but if added carefully and slowly a perfectly smooth paste will be obtained, provided, of course, the lime is of good quality. When the lime is slacked add sufficient water to the paste to bring the whole up to 25 gallons. When the copper sulphate is entirely dissolved and the lime is cool, pour the lime, milk and copper sulphate solution slowly together into a barrel holding 50 gallons. The milk of lime should be thoroughly stirred before pouring. The method described insures good mixing, but to complete this work the barrel of liquid should receive a final stirring for at least three minutes with a broad wooden paddle.

It is now necessary to determine whether the mixture is perfect—that is, if it will be safe to apply to tender foliage. To accomplish this two simple tests may be used. First insert the blade of a pen knife in the mixture, allowing it to remain there for at least one minute. If metallic copper forms on the blade, or, in other words, if the polished surface of the steel assumes the colour of copper plate, the mixture is unsafe and more lime must be added. If, on the other hand, the blade of the knife remains unchanged, it is safe to conclude that the mixture is as perfect as it can be made. As an additional test, however, some of the mixture may be poured into an old plate or saucer, and while held between the eyes and the light the breath should be gently blown upon the liquid for at least half a minute. If the mixture is properly made, a thin pellicle, looking like oil on water, will begin to form on the surface of the liquid. If no pellicle forms, more milk of lime should be added.

The foregoing directions apply to cases where small quantities of the mixture are needed for more or less immediate use. If spraying is to be done upon a large scale, it would be found

To spray on a large scale.

much more convenient and economical in every way to prepare what are known as stock solutions of both the copper and lime. To prepare a stock solution of copper sulphate, procure a barrel holding 50 gallons. Weigh out 100 pounds of copper sulphate, and after tying it in a sack suspend it so that it will hang as near the top of the barrel as possible. Fill the barrel with water, and in two or three days the copper will be dissolved. Now remove the sack and add enough water to bring the solution again up to the 50-gallon mark, previously made on the barrel. It will be understood, of course, that this second adding of water is merely to replace the space previously occupied by the sack and the crystals of copper sulphate. Each gallon of the solution thus made will contain two pounds of copper sulphate, and, under all ordinary conditions of temperature, there will be no material recrystallization, so that the stock preparation may be kept indefinitely.

Stock lime may be prepared in much the same way as the copper sulphate solution. Procure a barrel holding 50 gallons, making a mark to indicate the 50-gallon point. Weigh out 100 pounds of fresh lime, place it in the barrel, and slack it. When slacked, add sufficient water to bring the whole mass up to 50 gallons. Each gallon of this preparation contains, after thorough stirring, two pounds of lime.

When it is desired to make Bordeaux mixture of the 50-gallon formula it is only necessary to measure out three gallons of the stock copper solution, and, after thorough stirring, two gallons of the stock lime; dilute each to 25 gallons, mix, stir, and test as already described. One test will be sufficient in this case. In other words, it will not be necessary to test each lot of Bordeaux mixture made from the stock preparations, provided the first lot is perfect and no change is made in the quantities of the materials used. Special care should be taken to see that the lime milk is stirred thoroughly each time before applying. As a final precaution, it will be well to keep both the stock copper sulphate and the stock lime tightly covered.

Whatever kind of spraying pump is used for applying Bordeaux mixture must be provided with a nozzle that will furnish a mist-like spray, and at the same time be easy to clean of any obstruction that may clog the necessarily small opening. There is no form of nozzle that so well fills these requirements as the Vermorel, which is now sold with nearly all spraying outfits.

To ensure freedom from lumps of lime, it is often advisable to pass the mixture through a fine wire sieve or strainer before commencing to spray.

For apple scab, spray before the leaf-buds open, repeat before the blossoms expand and again just after the blossoms fall (these two applications are most important). If necessary, repeat again in ten days' time; this will depend upon weather conditions and variety treated. Wooden or earthen vessels only should be used in making Bordeaux Mixture.

No. 5.—KEROSENE EMULSION; ingredients:—

Hard soap shaved fine	1 lb.
Water	1 gal.
Kerosene	2 gals.

Dissolve the soap in boiling water, add the kerosene to the boiling suds, then churn with a force pump for a few minutes until the whole forms a creamy mass, which will thicken into a jelly-like substance on cooling. The emulsion thus made is to be diluted before using with nine to twelve gallons water.

It is worthy of note that the emulsion is much more easily made with soft water, and if water is very hard it is difficult to make a permanent emulsion.

It is advisable, therefore, to use rain water, or soften hard water by adding soda or borax.

Kerosene emulsion has an established reputation in the Eastern Provinces and States as a remedy for plant lice, but on the Pacific Coast has not proved so satisfactory, injuring foliage in some cases, and costing too much in comparison with other sprays used for the same purpose.

No. 6.—TOBACCO AND SOAP WASH:—

Soak 4 lbs. waste tobacco in 9 gals. hot water for four or five hours (or in the same quantity of cold water for 4 or 5 days); dissolve 1 lb. whale oil soap in 1 gal. hot water; strain the tobacco decoction into the dissolved soap and apply the mixture to

Directions. affected trees with a spray pump, using a fine nozzle and all the force possible.

Or the mixture may be applied directly to the insects with a swab or brush.

A good summer wash for all forms of aphides.

No. 7.—RESIN WASH—For Aphis and Scale Insects; ingredients:—

Resin	4 lbs.
Sal soda	3 "

Place the resin and sal soda in a kettle with three pints of cold water (soft or rain water). Boil or simmer slowly until thoroughly dissolved when it will look black. The sal soda will adhere to the sides of the kettle and must be scraped down. When sufficiently

Directions. boiled, the resin being completely dissolved, add enough hot water to make 50 gallons. After adding the water it will become thick, but after boiling again it becomes thin. The above is ready for immediate use and should be used lukewarm. If desired for future use, make as directed above, but add only five gallons of water and boil until thick. When required for use, dilute with boiling water as follows and stir thoroughly, when applying:—

For hop-louse	1 gallon compound to 9 gallons water.
For woolly aphis	1 " " 7 "
For scale insects	1 " " 6 "
For green aphis	1 " " 9 "

The spray is not injurious to the tree, for after three or four days sunshine it dissolves and leaves the pores of the bark open.

No. 8—HELLEBORE SPRAY—For Pear and Cherry Slugs, Gooseberry and Currant Worms; ingredients :—

Hellebore.....	1 oz.
Water	1 gal.

Directions. Steep the hellebore for an hour in one pint boiling water, then add the balance of water cold. To be used with spray pump.

NOTE.—Hellebore may be applied as a powder, dusted on the trees or plants treated. A machine known as Leggett's Powder Gun is a very efficient means for its use on a large scale. In all cases, care should be taken to obtain good fresh hellebore, to ensure the results aimed at.

No. 9—PARIS GREEN SPRAY—For Codlin Moth, Caterpillars, and other leaf-eating insects; ingredients :—

Paris Green.....	4 ozs.
Fresh slacked lime.....	1 lb.
Water	50 gals.

Make a paste of the Paris green with a little water. Make the lime into milk of lime of water, mix both these together, and add water to 50 gallons altogether. Paris green is a heavy powder, and will not remain long in suspension, hence it must be kept

Directions. constantly stirred when using. Be sure that good fresh lime is used to prevent the burning of foliage. Apply with spray-pump. London purple may be used in place of Paris green, but is not usually so reliable.

Paris green can generally be used to advantage with Bordeaux mixture, making a combined fungicide and insecticide, in the proportions given above, viz. :—4 ozs. Paris green to 50 gallons Bordeaux mixture. Apply with spray-pump.

Spray No. 10—AMMONIACAL COPPER CARBONATE:—This will not be used so freely as the Bordeaux mixture, on account of its greater cost and the increased labour of preparing it; but for spraying late in the season, when there is risk of staining the fruit with Bordeaux mixture, it is the most useful agent which has yet been tried :—

Copper carbonate	5 ozs.
Ammonia.....	2 quarts.
Water	50 gallons.

Dissolve the copper carbonate in the ammonia and dilute with water to 50 gallons. The concentrated solution should be poured into the water. Keep the ammonia in glass or stone jar tightly corked.

Home manufacture of copper carbonate.—As the precipitated form of carbonate of copper is not always obtainable, the following directions are given for its preparation :—

In a vessel capable of holding two or three gallons, dissolve $1\frac{1}{2}$ lbs. of copper sulphate in 4 pints hot water. In another vessel dissolve $1\frac{3}{4}$ lbs. sal soda (washing soda) in 4 pints hot water. When both are dissolved, pour the second solution into the first and

How to use it. stir briskly. When effervescence ceases, fill the vessel with water and stir thoroughly. Allow this to stand 5 or 6 hours, when a precipitate or sediment will have settled at the bottom. Now pour off the clear liquid without disturbing this sediment, fill up the vessel again with water and stir as before, then allow this to stand until the sediment has again settled, and then pour off the clear liquid carefully as before; the residue or sediment is carbonate of copper, and from the quantities given there should be formed 12 ounces weight. Instead of drying this (which is a slow process), add to it 4 quarts strong ammonia, stirring well, and then add water to bring the whole quantity up to 6 quarts. This may be kept in an ordinary stone jar, but should be closely corked.

Each quart will contain two ounces carbonate of copper, which when added to 20 gallons water will furnish a solution ready for spraying, of the same strength and character as that obtained by the use of the dried carbonate of copper.

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Caution -- Most of the copper compounds corrode tin and iron. Consequently, in preparing them for use, earthen, wooden or brass vessels should be employed; and in applying them, the parts of pump which come in contact with the liquid should be made of brass.

No. 15—LYE AND SOAP WASH—For winter use only; ingredients:—

1 lb. concentrated lye.
1 lb. whale oil soap.
5 gallons water.

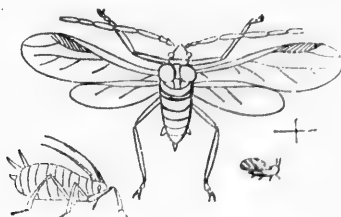
Dissolve the lye and soap in the water heated.

This mixture may be applied with a swab or brush, or with the spray pump, if used warm. One thorough application in the fall, and another before growth commences in the spring, should be made when used against woolly aphides.

Directions.

This is also an excellent wash to remove moss and lichen from trees and bushes, and if used for this purpose alone, half the amount of soap is sufficient.

INSECT PESTS.



GREEN APHIS. (Greatly magnified.)

Apple Aphis (*Aphis Mali*) is reported from all parts of the Province; very injurious to apple trees in some districts, especially in the interior. This pest is so well known and has been so often described that it is hardly necessary to repeat its life history at length. They injure trees and plants by sucking the sap.

The eggs of Green Aphides are deposited in the fall, usually on the extremities of the new growth, or around the buds. Two thorough applications of the No. 1 spray, according to the directions given, or of the lye and soap wash (No. 15), will destroy the eggs, and this is by far the best method of dealing with the pest, in the first instance. In a natural way the eggs hatch off just when growth commences in the spring, and the leaves of infested trees soon become curled and rolled up, making it very difficult to reach them with any spraying mixture.

They multiply at an enormous rate, those first hatched giving birth to living young, which in their turn reproduce in the same way, and so on for several generations, so that as fast as new leaves expand, they are attacked, if the weather conditions are favourable to the aphides.

The most successful summer sprays are Nos. 2, 6, or 7, any one of which, if used as directed, will give good results. The spraying should be repeated at intervals, and care taken to do the work thoroughly, as the washes kill only by actual contact with the insects.

During the summer winged broods of the pests are born; these should be looked out for, and prevented from establishing themselves by a timely use of one of the spraying mixtures referred to.

Black Aphis (*Myzus cerasi*) is also common throughout the Province, often seriously checking the young growth of the cherry trees. It winters over in the egg stage, and its life history is similar to that of the green aphid. It is found more difficult to kill by spraying than green aphid, but a thorough use of any one of sprays 2, 6, or 7 will keep it in check. Spray No. 1 should be used to destroy the eggs during the dormant season.

The Currant Aphis (*Myzus ribis*) is another form of aphid very common in Lower British Columbia and generally reported. It is yellowish in colour, and is found on the under sides of the leaves of currant bushes, which become curled and blistered.

Currant Aphis. They migrate during the summer, but return later on, and their eggs are deposited on the stems, especially around the buds. Spray with the No. 1 mixture to destroy the eggs in the winter months, and with either of sprays No. 2, 6, or 7 in the growing season, directing the spray so that the under sides of the leaves are reached. It is most important that the work should be done early in the season, before they become too numerous, and the leaves roll up so that sprays cannot reach them.

The Mealy Plum Aphis (*Aphis prunifolia*) is a species of aphid which attacks the young shoots and under sides of the leaves of plum and prune trees. It is widely distributed throughout the Province, and is particularly injurious in the Okanagan District; many trees were found completely covered with the pest during the two past seasons, checking the growth of the trees and the development of the fruit.

When first hatched they are whitish in colour, but as they increase in size they become darker. The insects and infested leaves are covered with a whitish powder.

Their life history is similar to that of the green aphid, and the remedies used for that pest should be applied, taking care to wet the under sides of the leaves, and repeat the spraying to insure the destruction of the pests.

The Cabbage Aphis (*Aphis brassicae*) is generally reported and is the most injurious insect enemy of plants of the cabbage family found in the Province. The past two seasons have been very dry and favourable to the development of this pest, so that large quantities of cabbage, cauliflower, turnips, etc., have been completely spoiled by it, especially on the Islands. It is also found on wild cruciferous plants, such as wild mustard. It has much the same general appearance as the apple aphid, with the addition of a whitish, mealy coating.

During the summer months the young are born alive, but in the fall true males and females are developed, and eggs deposited upon the leaves and stalks of its food plants. From this it follows that cabbage stalks and other plant remnants should be used up or destroyed, as well as weeds upon which the pests feed, as a preventive measure.

The most useful summer spray against this pest is the quassia and soap wash (No. 2). No. 6 is also effective, but these remedies, while quite practical for garden crops, would be too costly for use on field crops, especially in dry seasons. In the garden plenty of water can generally be used to keep the plants in a thriving condition, and this is quite as important as the spraying.

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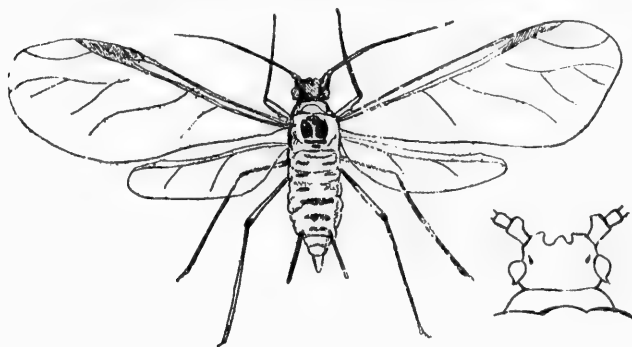
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HOP APHIS (*Phorodon humuli*).



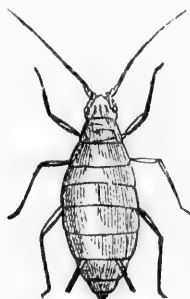
(FIG. A.)

Winter egg of the hop plant louse, and the shrivelled skin of the sexual female which laid them. (Enlarged.)



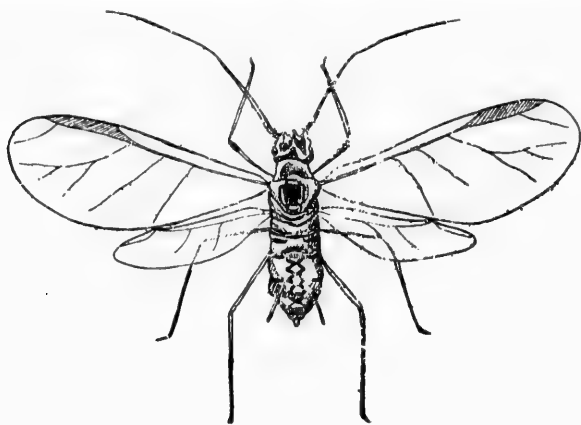
(FIG. B.)

The hop plant louse, third generation on plum the generation which flies to the hop plant. Head below at right. (Both enlarged.)



(FIG. C.)

The hop plant louse, true sexual female. (Enlarged.)



(FIG. D.)

The hop plant louse, male. (Enlarged.)

The above are reported from Okanagan, Mission, Hazelmere, Shortreed, Kamloops Alder grove, Steveston, Squamish and Saanich.

Wherever it occurs, whether in England or on the continent of Europe, in New York, Wisconsin, or on the Pacific Coast, the Hop Plant Louse (*Phorodon humuli*) has substantially the same life round. The eggs are laid in the fall on different varieties and

Hop Aphis. species of the plum, both wild and cultivated. They are small, glossy, black, ovoid, and are attached to the terminal twigs, especially in the more or less protected crevices around the buds.

From an egg hatches in the spring, about the time when the plum buds begin to burst, a stout female plant louse, known as the stem-mother, which differs from the summer individuals by having shorter legs and shorter honey tubes.

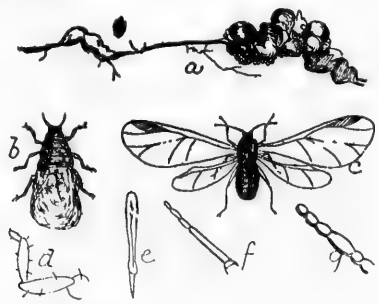
She gives birth, without the intervention of the male, to living young, and this method of propagation continues until the last generation of the season. The second generation grows to full size and gives birth to a third, which becomes winged, and develops after the hops have made considerable growth in the yards. The winged lice then fly from the plums to the hops, deserting the plum tree entirely and settling upon the leaves of the hops, where they begin giving birth to another generation of wingless individuals. They multiply with astonishing rapidity. Each female is capable of producing on an average about one hundred young, at the rate of three per day, under favourable conditions. Each generation begins to breed about the eighth day after birth, so that the issue from a single individual runs up, in the course of a summer, to trillions. The issue from a single stem-mother may thus, under favourable circumstances, blight hundreds of acres in the course of two or three months. From five to twelve generations are produced in the course of the summer, carrying us in point of time to the hop-picking season. There then develops a generation of winged females (*sexuparae*), which fly back to the plum tree and give birth to the true sexual females, which never acquire wings and never leave the plum tree. By the time this generation has matured, which requires but a few days, varying according to the temperature, belated winged individuals, which are the true males, fly in from the hop fields. These fertilize the wingless true females upon the plum leaves, and these soon thereafter lay the winter eggs. Thus there is but one generation of sexed individuals produced, and this at the close of the life round—the females wingless on plum trees; the males winged on hops. All intervening generations are composed of virgin females only (*parthenogenetic*). This is the invariable round of the insect's life.

From the life history just given, three important facts are obtained: (1.) It will pay to make a preventive application of some of the mixtures mentioned further on, with apparatus before described, to all plum trees in the neighbourhood of hop yards, either

Remedies. in the spring, before the appearance of the first winged generation and its consequent migration to hop, or in the fall after hop picking and after the lice have once more returned to the plum, and are making their preparations for the laying of winter eggs. The latter time will, perhaps, be preferable, for the reason that in the fall the plum trees will be less susceptible to the action of the washes, and a stronger solution can be applied without danger to the trees. (2.) All wild plum trees in the woods through a hop-growing country should be destroyed. (3.) The hop vines should be either burned or thoroughly drenched with kerosene emulsion as soon after the crop is harvested as possible, with a view of killing the males, and thus preventing the impregnation of the females. (4.) If the above measures have been neglected and the lice have attacked the vines, the crop can still be protected by spraying with insecticide mixtures, which, if thoroughly applied will prove effective, and there will be no danger of reinfestation from neighbouring untreated yards, since during the summer the lice cannot migrate except by crawling from one yard to another.

Mr. Chas. Whitehead, F.S.A., etc., etc., Agricultural Adviser to the Privy Council, says in reference to the formula given below: "There are no actual proofs that any other remedy or treatment than washing is at all effectual against the aphid blight. Lime has been thrown up over the plants without any results. Soot has been tried. Insecticides are dead failures, and manurings have had no marked influence."

Spraying with any of the well-known insecticides by means of a horse sprayer up and down the rows. The following formula for a spray is recommended by the Board of Agriculture of England and is found to be most effectual: A decoction of 10 lbs. of quassia chips made by boiling; 7 lbs. soft or whale oil soap, and 100 gallons of water. The chips may be used twice, the second decoction being of course weaker. The hops should be sprayed at least five times during the summer, and if the insects are very bad, oftener.



WOOLLY APHIS (*Schizoneura lanigera*). After Riley.

(a), an infested root; (b), the larva—colour brown; (c), winged adult—colours, black and yellow; (d), its leg; (e), its beak; (f), its antenna; (g), antenna of the larva; all highly magnified.

This aphid is also widely distributed in the lower parts of the Province, and is firmly established in most of the old orchards in and near the cities. It is generally considered the most troublesome insect pest of apple trees we have, from the difficulty

Woolly Aphis. experienced in cleansing an orchard infested with it, and its harmful effect upon the trees. Its name of woolly aphid is derived from the secretion resembling fine cottony fibre, which more or less covers its body. The insects appear on infested trees during the summer in masses like tufts of cotton, attached to the twigs or leaves, beneath which will be found the bodies of the insects.

In the winter months they shelter under the bark or in cavities in the wood of the trees, or descend to the roots; large numbers will often be found at or near the collar of the root.

The eggs of woolly aphides are stated by Dr. Smith "to be found singly in crevices of the bark, enveloped in the dry skin of the female."

During the summer months they reproduce in the same manner as green aphides, but winged forms appear only in the fall.

During our mild winters in the coast districts, woolly aphides may be found in different stages of development, showing that if egg laying takes place, the eggs probably hatch off at once, and new colonies are started, or that viviparous reproduction goes on without the necessity of egg laying. The prevalence of dead-spot or bark disease in apple trees gives just the condition of the bark which favours the pests, by providing them with shelter, and increases the difficulty of reaching them with spraying mixtures.

It is therefore important that, as far as possible, dead and decayed bark and all superfluous limbs and branches of infested trees should be removed before spraying is done, to allow the mixture used to penetrate all parts of the trees.

The best winter wash is the No. 1 spray; the lye and soap wash (No. 15) is also effective. At least two applications should be made to badly infested trees, and the spray applied warm, with all the force possible, by means of a good spray pump. During the summer months, masses or colonies of the aphides occurring on the trunk or limbs may be destroyed by touching them with a swab or brush dipped in coal oil, or either of sprays No. 6 or 7, applied with the spray pump. It will be necessary to repeat the treatment at intervals to keep the pests in check, until the strong winter washes can be used. For the root form of woolly aphides the No. 1 spray is effective, or the lye and soap wash used freely, especially where the stem and roots join. These substances will also act as fertilisers to the trees. To increase their effect, the roots of infested trees should be uncovered as far as possible before applying. Refuse tobacco dug in about the roots will also help to keep down the pests.

The Missouri Experimental Station have made extensive experiments with different methods of killing woolly aphides, particularly the root form of the pest, and a bulletin issued by the station states that the root form may be cheaply and easily killed, and kept away from the roots of apple trees by a liberal use of tobacco dust, applied by removing the earth from around the trunk for a distance of two feet, and four inches in depth, evenly filling the space with tobacco dust, and covering it with earth.

As a preventive measure, tobacco dust should be used freely among and over the roots of newly planted trees and nursery stock.

Specimens of woolly aphides of different species were sent by Mr. E. A. C. Gibson to Dr. Fletcher, who writes in regard to them as follows:—"In the box of which you describe the specimens as taken off an apple twig badly infested with woolly aphides; these were the true *S. laevigera*, but amongst them were some other specimens of *aphis malifolia*, which has the venation very similar to that given of *aphis mali*, on page 163 of my last report. The difference between these two last named species are chiefly colourational and in the size of the insect. The other box containing specimens of the woolly aphid, which has given you so much trouble to identify, and which are flying in such myriads in your woods, are neither the alder aphid nor the true woolly aphid, but a species called *Pemphigus pyri*, which belongs to the same genus as the alder woolly aphid.

"The difference between these two genera is very easy to recognise when once pointed out, and that is, in the genus *Schizoneura*, the third discoidal vein is forked, while in *pemphigus* all the veins are simple.

"*Pemphigus pyri* probably is a native species with you, and occurs through your woods on different species of *pyrus* and *crataegus*."

This species of woolly aphid (*Pemphigus tessellata*) is very common upon alder trees in lower British Columbia, and is often confounded with the woolly aphid of the apple, from which it is quite distinct. Like other aphides, they reproduce by giving birth to living young. Vast numbers of winged specimens appear in the fall and spread over the country, the air sometimes appearing full of the insects moving with the wind. They have not been found injurious to fruit trees, although many of these winged specimens are found on them. They do not seem to reproduce except on their proper food plant.

The Woolly
Alder Aphid.

Ants (*Formicidae*) are reported from all parts of the Province. There are many different varieties of ants, the most generally troublesome one being the small red ant (*monomorium pharaonis*.) Ants are well known to most fruit-growers in connection with

Ants as a Pest. green and other aphides, and will be noticed running up and down trees or plants infested with them; by some persons they are supposed to destroy the aphides, while the true facts are that the ants, while feeding upon the sweet fluid or honeydew which exudes from the bodies of aphides, protect and care for them, will carry them from tree to tree, defend them if possible from predaceous insects which would destroy the aphides, and so are directly instrumental in increasing the damage done by these pests.

To destroy ants, their nests should be located, then one or more holes, according to the size of the nest, poked into it with a stick and three or four ounces of bisulphide of carbon poured in, and the holes closed again with the foot. The fumes will penetrate the chambers of the nest and will usually kill all or most of the inmates.

Dr. Riley recommends the following: "A number of holes are punched in the nest by means of a pointed stick; a teaspoonful of the bisulphide carbon is then poured down each hole, and a damp blanket thrown over the nest for a few minutes; then the blanket is removed, and the bisulphide exploded at the mouth of each hole by means of a light at the end of a pole. The slight explosions which follow drive the poisonous fumes of the gas generated down through the underground tunnels, killing off the ants in immense numbers."

As bisulphide of carbon vapour is very inflammable, care must be observed in its use.

Ants may be prevented from ascending fruit trees by painting a narrow circle of tar around the trunk, near the ground. It is also worth noting that the common guinea fowl is very fond of their eggs, and will destroy their nests to get them.

For ants in houses Dr. Smith writes that he obtains good results by dipping a sponge in sweetened water, which should be placed where the ants run. The news of its presence will spread and the ants will swarm to fill the sponge; when this takes place the sponge should be taken up and dipped in boiling water. If this process is repeated for two or three days the insects are seized with terror from the sudden lessening of their numbers and will abandon the house and their nest as well.

Fresh bones, from which the meat has been roughly scraped, may be used in the same way and with the same effect.

Specimens of tingis (*Tingitida*) have been sent in for identification and reported as injurious to the leaves of fruit trees. They are found on the undersides of the leaves—small,

whitish, flat insects with gauze-like broad wing covers, usually in masses together. They suck the sap of the leaves. The insects are black or brown in colour. Some of the adults usually live through the winter, and the females deposit their eggs in the spring, but sometimes eggs are laid in the fall and the winter passed in that stage. For shelter in the winter fallen leaves are used, or the adult insects creep under loose bark scales or into crevices. In the summer the insects may be destroyed by using either of sprays No. 2, 6, or 7 with the spray pump, taking care to reach the undersides of the leaves.

Of this species of insects there are many members, some of which do considerable harm to fruit and ornamental trees, and bushes. Rose bushes are especially subject to attack in

Victoria and adjoining districts. They usually feed on the undersides of leaves, and take their food by suction, the infested leaves lose their colour in spots. They are small in size, slender, and active, with the head so narrow that they seem to be pointed at both ends. The wings are laid longitudinally on the back, are narrow and transparent. They run and fly readily; some of them jump or spring when disturbed.

These insects thrive in hot, dry weather, hence become more injurious, as plants are less able to resist them, so that in addition to destroying the pests the plants should, if possible, be well watered and fed.

Either the tobacco and soap (No. 6) or the quassia and soap wash (No. 2) will give good results against these pests, but care must be taken to wet the undersides of the leaves.

As many of these insects winter in the adult stage under rubbish or loose bark, etc., clean culture in the garden is indicated as a means of lessening their numbers.

Of this family (*Capsida*), the four-lined plant bug has been noticed and reported from several places, and several other varieties are also found in the Province, some of which are, at least in a measure, beneficial, as they have been noticed feeding upon caterpillars. Plant bugs, however, are generally very unwelcome visitors, on account of their very unpleasant odour, and still more nauseous taste if they are inadvertently taken into the mouth with fruit, as often happens when they are present on raspberries or blackberries.

In addition to feeding upon the juice of the fruit, they also suck the sap of the leaves and young twigs. They are not easily dealt with, the application of insecticides being satisfactory. They winter in different stages of development. Their numbers may be reduced by collecting them in the morning before they become active, by shaking them off the bushes into some sort of a receptacle and then destroying them. As the eggs of some are laid upon the young twigs of currant and other fruit bushes, pruning off and burning these has been suggested as a partial remedy.

This dreaded pest of fruit and other deciduous trees, *Aspidiotus Perniciosus*, has made its appearance in two orchards on Vancouver Island, and it is most important that all fruit-growers should be on the watch for the pest and report to the Inspector of Fruit Pests, or the member of the Board of Horticulture for his district, if its presence is known or suspected, so that vigorous efforts can be made to stamp out the pest before it becomes firmly established.

It is important that there should be no half measures adopted in dealing with the San Jose scale. It has cost the fruit-growers of Oregon and California hundreds of thousands of dollars to fight the pest, and the war against it is likely to continue; its habit of feeding upon almost all kinds of trees and plants renders it almost impossible to get rid of the pest if neglected at first appearance.

It is scarcely possible that the infestation is limited to the instances referred to, and I propose during the coming season to give special attention to the districts where the infected trees were found, but I also hope the importance and necessity of all fruit-growers keeping a sharp watch upon their own and adjacent orchards, so far as possible, so that it may be detected before it is too late.

The appearance of San Jose Scale in the orchards and nurseries of some of the Eastern and Southern States has created wide-spread consternation amongst fruit-growers there, and a demand for legislative assistance in dealing with the pest similar to that existing in British Columbia and the Pacific Coast States has sprung up.

Apparently the pest had become well established before its presence was known or suspected. Vigorous efforts are now being made to deal with it, but for reasons previously stated, this is proving a very difficult task.

The life history and habits of the San Jose Scale have been studied to perhaps a greater extent than those of any other fruit pest, and following is given a concise account of these, to assist our fruit-growers to recognise it.

It belongs to the same group of armoured scale insects as the common oyster shell scale, but differs from that species in that the scale is perfectly round, or at most, very slightly elongated and irregular; it is flat and pressed close to the bark of the tree: at or near the centre of each scale is a small, round, slightly raised black point, or sometimes this point may appear yellowish.

The Scale
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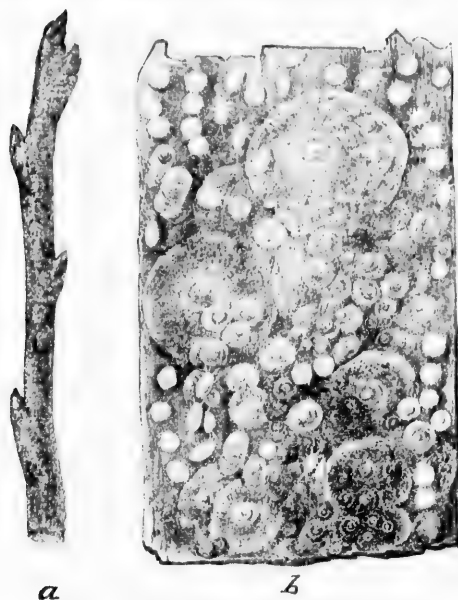
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(FIG. 2.)

Appearance of Scale on bark : *a*, infested twig, natural size ; *b*, back as it appears under hand-lens, showing scales in various stages of development and young larva.

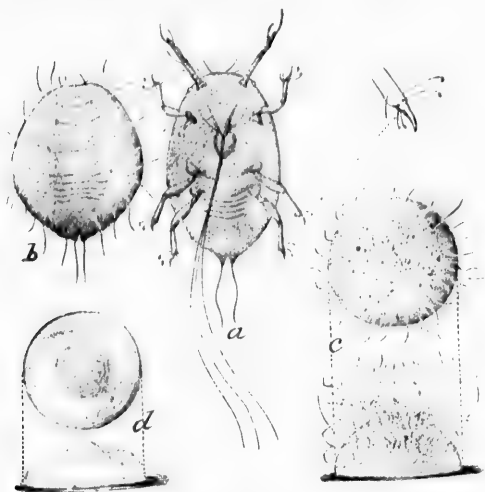
(*L. O. Howard and C. L. Marlatt, Bulletin No. 3, New Series, Division of Entomology, U. S. Department of Agriculture.*)

When occurring upon the bark in large numbers the scales lie close to one another, frequently overlapping, and are difficult to distinguish without a magnifying glass. The general appearance which they present is that of a grayish, roughened, scurfy deposit. When the scales are crushed a yellowish oily liquid will appear coming from the bodies of the insects, and this will indicate to one not familiar with their appearance the existence of living insects beneath the scaly covering.

The majority of the scales do not exceed one-sixteenth of an inch in diameter, but where only a few are found they become larger, and the females may reach an eighth inch.

Upon young shoots and leaves where the scales are not so thick the circumference beyond the scales frequently becomes changed in colour to a somewhat purplish or crimson shade.

The insect is also found on the fruit, and one of its most characteristic points in this case is the bright reddish or purplish discolouration around the edge of each scale. So far as known, this result is confined to this one scale insect. Upon the leaves of infested trees the insects have a tendency to collect along the midribs on the upper sides, in one or more quite regular rows. Infested leaves turn brown, but do not have a tendency to drop as a result of the damage done.



(FIG. 3.)

Young larvæ and developing scale ; (a), ventral view of larva showing sucking beak with setæ separated, with enlarged tarsal claw at right ; (b), dorsal view of same somewhat contracted, with the first waxy filaments appearing ; (c), dorsal and lateral view of same still more contracted, illustrating further development of wax secretion ; (d), later stage of same, dorsal and lateral views, showing matting of wax secretions and first form of young scale—all greatly enlarged.

(L. O. Howard and C. L. Marlatt, *Bulletin No. 3, New Series, Division of Entomology, U. S. Department of Agriculture.*)

"There are two points of interest and importance to be noted in this life history. The first is, that the insect passes the winter beneath the scales in a partly grown condition. Usually they are about half grown ; but some will be younger and some will be older. They seem to continue reproduction until the tree is entirely dormant, and no further food is obtainable. On the other hand, they do not seem to renew growth very early in spring, but are slow to begin reproduction ; no larvæ being noted until June. The second point is, that once they begin there is practically no period during the summer at which the young, active crawling lice are not to be found upon the tree. The length of time during which a given female will continue to reproduce has not been ascertained ; but it seems likely from what has been observed that breeding continues for quite a long time, and that the female scales that have lived during the winter may continue to live on and reproduce during the greatest portion of the summer, when their daughters and grand-daughters are already full grown, with nearly full grown progeny. There may be, therefore, upon a plant at one time, young born of as many as three or even four distinct generations."

Some Characteristics.

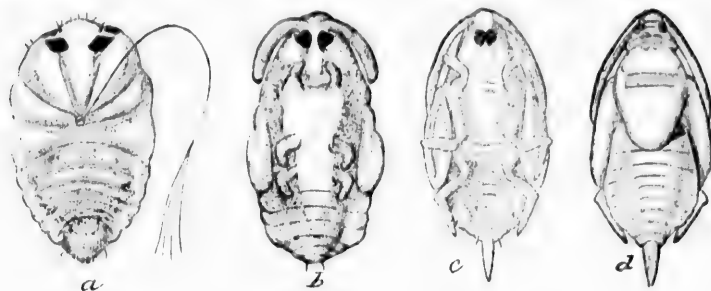


FIG. 4.

Development of male insect; (a) ventral view of larva after first molt; (b) same after second molt (propupa stage); (c) and (d) true pupa, ventral and dorsal view, all greatly enlarged.

(L. O. Howard and C. L. Marlatt, *Bulletin No. 3, New Series, Division of Entomology, U. S. Department of Agriculture.*)

The male of this species is a winged insect. It is very minute, scarcely noticeable without a lens, very light and frail, at the mercy of the least puff of wind, and incapable of any great journey. The female has no perceptible legs, and is utterly incapable of motion.

Process of Development.

She resembles a yellowish or orange, flattened seed, in bulk many times that of the male; but firmly fixed to one point by the scaly covering which is at once her protection and her grave. The young are active for a very brief time, two or three days at most, and they crawl with considerable rapidity and great persistence, so that they might possibly descend from one tree and crawl for a number of yards to another; but the spread in this manner is insignificant. Where trees are close together they may pass from the branches of one to the branches of another; but they rarely crawl long in any one direction; they rather move around, rapidly enough, yet irregularly and at random. Usually they do not go further than is necessary to find a good place to fix, and at once begin to form a scale. This process is rather interesting and can be watched. As soon as the young louse has inserted its beak into the plant and has begun to feed, a change comes over it, and within a few hours it is entirely covered by a fine, white, waxy film. This turns first yellow and then grey or even black, and the creature is a fixture, absolutely incapable thereafter of shifting its location under any possible circumstances. Strong winds may carry the young bodily from one tree to another; but the principal method of spread is by means of other insects which are winged, and by birds. The active young lice will soon crawl upon any small winged insect, particularly if the latter is of dark colour, and they may be carried by it to considerable distances. They also crawl upon the feet of birds which visit the trees, and thus may be carried for miles. They are often found upon ants, and ants, as everyone knows, are great travellers.

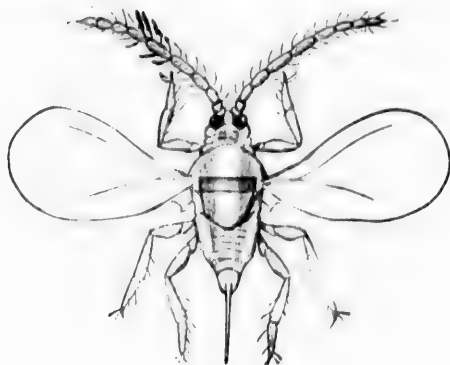
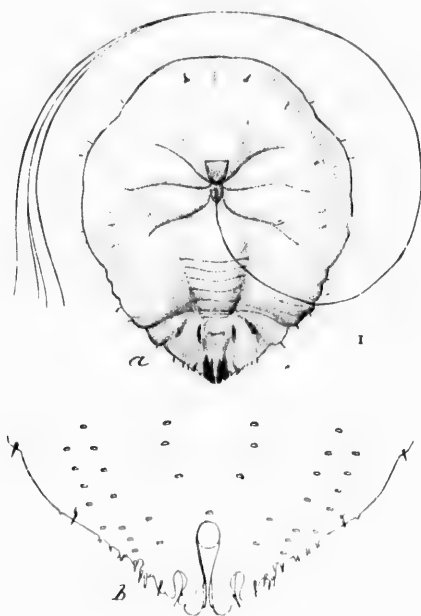


FIG. 5.

Adult male, greatly enlarged.

(L. O. Howard and C. L. Marlatt, Bulletin No. 3, New Series, Division of Entomology,
U. S. Department of Agriculture.)



(FIG. 6.)

Adult female before development of eggs; (a), ventral view, showing very long sucking setae; (b), anal plate, showing characteristic ornamentation of edge—greatly enlarged.

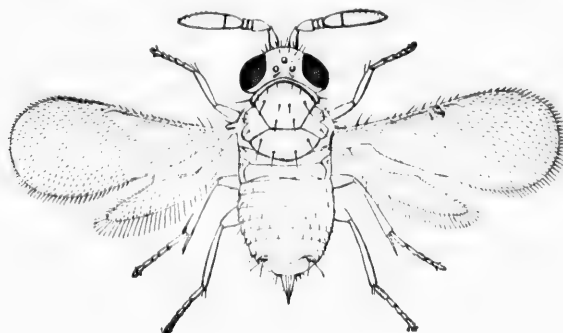
(L. O. Howard and C. L. Marlatt, Bulletin No. 3, New Series, Division of Entomology,
U. S. Department of Agriculture.)

In Oregon and California the No. 1 spray is largely used in fighting this pest, but in our case there is no question that the most strenuous efforts should be made in the first instance to completely extirpate the pest by cutting down and burning any trees found to be infested. As a measure of protection, all other trees or plants in the neighbourhood should be sprayed at least twice in the dormant season. As a summer wash, spray No. 3 is recommended in Oregon and California.

PARASITES AND NATURAL ENEMIES OF SAN JOSE SCALE.

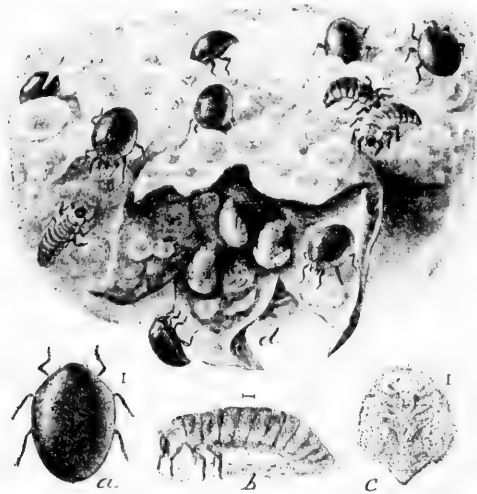
The most important parasite, perhaps, is *Aphelinus fuscipennis* (How.), a common enemy of armoured scales. The general characteristics of *fuscipennis* are well shown in the accompanying figure of a closely allied species. (Fig. 7.) This parasite has been

A. Fuscipennis. raised in large numbers in California. Mr. Alex. Craw reports it as doing very effective work in the neighbourhood of Los Angeles.



(FIG. 7.)—*Aphelinus diaspides*.)

(L. O. Howard and C. L. Marlatt, Bulletin No. 3, New Series, Division of Botany,
U. S. Department of Agriculture.)

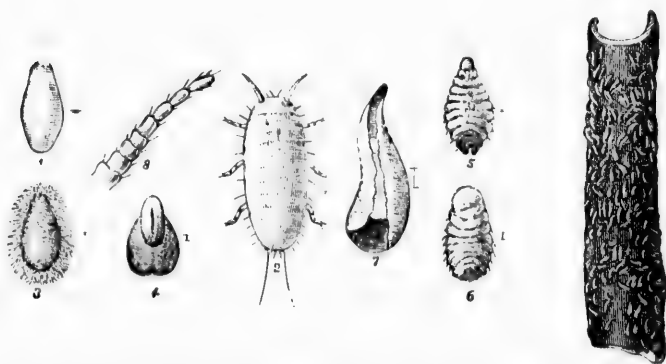


(FIG. 8.)

Pentilia (Similia) misella: (a) beetle; (b) larva; (c) pupa; (d) blossom end of pear, showing scales with larvae and pupae of *Pentilia* feeding on them, and pupae of *Pentilia* attached within the calyx. All greatly enlarged.

(L. O. Howard and C. L. Marlott, Bulletin No. 3, New Series, Division of Botany, U. S. Department of Agriculture.)

Of predaceous insects, perhaps the most interesting is the little coccinellid *Pentilia Misella* (Fig. 8). Both larvæ and beetles feed upon the scales. The beetles seeming to prefer the full grown female scales, and their larvæ the young scales. *Pentilia misella* is found both in the Eastern States and the Pacific slope.



The Oyster Shell Bark Louse (*Mytilaspia Pomorum*) is reported from Beaver Point, Nanoose Bay, Okanagan Mission, Notch Hill, Hazelmere, Sumas, Chilliwack, Dewdney, Victoria, Nanaimo, and New Westminster.

This is a very destructive and pernicious insect, which prevails throughout the Northern United States and Canada, and in some of the Southern States also. It was introduced from Europe more than eighty years ago. It appeared in the form of minute scales, about one-sixth of an inch long, of a brownish or greyish colour, closely resembling that of the bark of a tree, and somewhat like the shell of an oyster in shape, adhering to the surface of the bark, and placed irregularly, most of them lengthwise of the limb or twig, with the smaller end upwards. In some instances the branches of apple trees may be found literally covered and crowded with these scales; and where thus so prevalent they seriously impair the health and vigour of the tree, and sometimes cause its death.

Under each of these scales will be found masses of eggs varying in number from fifteen or twenty to one hundred or more. These during the winter or early spring will be found to be white in colour, but before hatching they change to a yellowish hue, soon after which the young insects appear. This usually occurs late in May or early in June, and if the weather is cool the young lice will remain several days under the scales before dispersing over the tree. As it becomes warmer, they leave their shelter and may be seen running all over the twigs looking for suitable locations to which to attach themselves. Their actual length being only about one-hundredth (of an inch), to the unaided eye they appear as mere specks. When highly magnified, they appear as at 2. A large proportion of them soon become fixed around the base of the side shoots of the terminal twigs, where, inserting their tiny sharp beaks, they subsist upon the sap of the tree. In a few days a fringe of delicate waxy threads issues from their bodies, as at 3. Gradually the insect assumes the form shown at 4. 5 and 6 present the larvæ as nearly full-grown, and when detached from the scale, before the end of the season the louse has secreted for itself the scaly covering in which it lives and matures, shown at 7. 8 represents one of the antennæ of the young lice. 1 shows the egg highly magnified.

Description and treatment.

By the middle of August this female louse has become little else than a bag of eggs, and the process of depositing these now begins, the body of the parent shrinking day by day, until finally, when this work is completed, it becomes a mere atom at the narrow end of the scale and is scarcely noticeable.

The scales of the male louse are seldom seen; they are most frequently found upon the leaves, both on the upper and under sides; they are smaller in size than those of the female and different also in shape.

In the orchard and its immediate neighbourhood it may be spread by being carried on the feet of birds, or attached to the larger insects, or may be aided by the wind in passing from tree to tree, while it is itself so brisk in its active state that it can travel two or three inches in a minute, and hence might in this way reach a point two or three rods distant before it would perish. Although this insect essentially belongs to the apple tree it is frequently found on the pear, and sometimes on the plum.

During the winter the trees should be examined and the scales scraped off, and the trees sprayed with No. 1 spraying mixture, and thus a large proportion of the insects may be destroyed. Still, it is almost impossible to cleanse the trees entirely in this way, especially the smaller branches, and hence the insect should be fought also at the time when the eggs are hatching and the young lice crawling over the limbs, as then they are tender and easily killed. With this object in view, the time of hatching of the remnants left after the winter or spring scraping should be watched, and while the young larvæ are active the twigs should be brushed with a strong solution of soft soap and washing soda, or sprayed with the resin wash. Spray No. 7.

As this scale (*Lecanium armeniacum*) has been found on two or three occasions in the Province, and will feed upon other deciduous trees, as well as the apricot, it should be looked out for by fruit-growers. The scale is boat-shaped, when matured somewhat wrinkled. The colour is a shiny brown, darker in the centre than at the edges. It hatches from eggs during May and June. The treatment advised for the Oyster Shell Scale should be followed in dealing with this pest.

Brown Apricot Scale.

This insect (*Macrodactylus subspinosus*) feeds in the beetle stage upon a great variety of trees and plants, injuring the flowers and foliage. It has been very troublesome at Agassiz.

The beetle is a hard, brown insect about half an inch long, and makes its appearance in early summer. According to Dr. Riley's observations, the eggs are deposited usually in the soil of open land or cultivated fields, particularly where the soil is light or sandy. In two or three weeks the eggs hatch, and the larvæ feed upon the roots of grass and other plants. They winter in the soil and change to the pupal state there, emerging as the perfect beetle in early summer.

This is considered one of the most difficult insect pests to fight. Spraying with Paris green (Spray No. 9) has given good results in some cases, but hand-picking the insects in the cooler hours of the day, while slow, has proved the surest method of dealing with the pests when not too numerous. Where they are present in large numbers, Dr. Smith reports good results from collecting the beetles by means of funnel or umbrella-shaped collectors. The beetles drop readily when the infested plants are jarred, and the collectors are so made that the insects roll to the centre and into a pail containing kerosene.

The Potato Blister Beetle (*Epicauta maculata*) is reported from Ashcroft and Chilcotin, and is found generally in the interior valleys. This pest is very destructive in potato and garden patches, generally appearing in May and lasting till the middle of

Potato Beetle.

August. It is a greyish-black beetle; in cool weather it is sluggish and can be readily hand-picked or brushed off the plants into some convenient vessel. Mr. Fletcher recommends as a remedy one pound of Paris green to 100 gallons of water, or one pound to 50 pounds of ashes or other fine powder sprinkled over the leaves. It should be mentioned that these beetles in their larval state feed, so far as known, exclusively upon the eggs of locusts (grasshoppers), and are thus of great benefit.

Turnip Flea or Beetle (*Phyllotreta vittata*—Fab.). Prevalent in all parts of the Province where the crops it feeds upon are grown. It attacks turnips, cabbages, mustard, radish, and other plants of the same family; especially injurious to the young plant

Turnip Beetle. when it first appears above ground, often necessitating a re-sowing of the crop.

It is a small, shiny black beetle, with a yellow, longitudinal stripe on each wing-cover. The eggs are deposited on the roots of the plants it feeds upon, and the larvæ which hatch feed upon the roots, so that it is injurious in both stages of its existence. The beetles pass the winter beneath rubbish or clods of earth, and make their appearance early in spring.

Dr. Fletcher says: "I have found the most successful treatment of this insect to be the sowing of perfectly dry land plaster or ashes, with fifty parts of which one part of Paris green had been mixed. Other experimenters speak highly of a decoction of waste

Preventatives.

factory tobacco, one pound in two or three gallons of water. This latter remedy is useful upon garden cress, where Paris green cannot be used." Fresh slaked lime dusted on the young plants is a good preventative of injury, and good results have been obtained by using the well-known Bordeaux mixture sprayed on the plants to be protected.

The larvæ of this beetle (*Polyphylla decemlineata*) has done much damage to nursery stock and strawberry plants on the grounds of Mr. J. A. Knight, Mount Tolmie. The beetle

Western
Ten-lined
June Bug.

itself is $1\frac{1}{2}$ inches in length by over $\frac{1}{2}$ an inch wide. It is shaped like the ordinary June bug, is of a tawny brown appearance, with four white stripes and a short dash from the shoulders on each wing case. The colour of the wing cases is really black, but they are so covered with tawny scales as to give the beetles a brown appearance. The larva of this beetle, when full grown and stretched to its full length, is $2\frac{1}{2}$ inches in length, by $\frac{5}{8}$ in. wide. The body is curved and white, the head pale chestnut, the mandibles black.—[Fletcher.]

This is a very difficult pest to deal with, ordinary insecticidal remedies not being applicable. Prof. Smith advises fall ploughing of infested land, with heavy top-dressings of kainit or muriate potash and nitrate of soda. Chickens should be encouraged to follow in the fresh turned furrows to pick up the grubs. Although this pest is only reported from one point, it is probably not confined to that place, and should be looked out for.

The larvae of click beetles (*Elateridae*) are well known as "wire-worms." The species troublesome to us appear early in spring in the beetle form, and in some localities on the lower Mainland have been very injurious, destroying the blossoms of fruit-trees.

Wire-worms. In this stage the only practical remedy so far has been to jar infested trees, which causes the beetles to fall, and remain quiescent for a short time, so that they may be collected on a sheet spread for the purpose and destroyed. Mr. E. Hutcheson found this plan quite effective.

To wire-worms in the soil, the direct application of insecticides is usually impracticable. Methods of cultivation calculated to avoid injury are more satisfactory.

Grass land known to be infested should be fall ploughed, and while this will not destroy any large proportion of the larvae, it will kill most of the pupae and beetles then in the ground, so if the practice be continued for a series of years, the insects will gradually run out.

Frequent change of crops is also advised, and the growing of crops which require clean cultivation. Miss Ormerod recommends the growing and ploughing in of mustard as a good preventative measure.

Mr. Fletcher says (Report 1885, page 17):—"Most of my correspondents agree that the attacks from wire-worms (sometimes called yellow worms) are much less severe upon well manured, highly cultivated and well cleaned ground. Mr. William Miller, of Bridgetown, N.S., a gentleman of large experience and a successful farmer,

What Dr.

Fletcher says.

tells me he can clear any ground from wire-worms by high culture and careful cleaning by the third crop. Where potatoes are grown they should be picked up immediately they are dug, and most of the wire-worms will be taken out with them and can be destroyed. He mentioned an instance of a piece of land he had just cleared which, when he took it, was so full of wire-worms that he had been able to gather them up by the handful from the bottom of the cart in which the potatoes were drawn from the field. In confirmation of this, I give the following quotation from the report which has just been issued by Mr. C. Whitehead for the Agricultural Department of the Imperial Privy Council Office in England: 'First and foremost among means of prevention (of wire-worms attacks on crops) is the abolition of weeds from the land and from the outsidies of fields.' This has been recognised and adopted long ago by some agriculturists, for we find the following passage in Vol. XV. of the Journal of the Royal Agricultural Society of England, in an essay upon the farming of light land, which is always more liable to attacks of wire-worms. 'There is a farm in the neighbourhood of Guildford which presents an instance of a perfectly clean farm, and kept so by deep ploughing and unsparing use of horse and hand hoes. It has often been remarked that root crops and corn are unmolested by wire-worms upon this farm. The owner asserts that he starved them long ago by growing no weeds to sustain them in the absence of a crop.'

The following is taken from the *American Garden*, and will do for horticulturists:—

"Add three or four pounds of unslacked lime to every bushel of soil. This will make the wire-worms so sick that they will give the seedling carnations a wide berth in the future:

Remedy for

Wire-Worms.

besides the health and colour of the plants will be so much improved that we will think that they belong to a new race of pinks. The best way to use lime is to spread the soil in a flat heap ten or twelve inches thick, then place the desired amount of lime in lumps on the top. When the latter has become slaked and pulverised the soil should be turned over two or three times and thoroughly mixed. It is then ready for use."

The parent beetle of the round-headed apple tree borer (*Saperda candelida*) is easily recognised by the brown colour of its body, and the two conspicuous, longitudinal, whitish stripes along its back. It appears early in the summer, and deposits its eggs on the tree

**The
Round-headed
Apple-tree
Borer.**

trunks, in or under the bark, within a few inches of the ground, frequently placing them just above the soil surface, or even below it where the ground is cracked open so that the beetle can descend without difficulty. The insect makes a slit-like opening in the bark into which the egg is pushed. A few days later the egg hatches into a larva or grub, which gnaws its way into the inner bark or sapwood, where it continues to feed throughout the season. As winter approaches it frequently burrows downward below the surface of the ground, and rests there until spring, when it again works upward and outwards to the bark, lining a cavity at the end of its burrow with dust-like castings, and there rests until spring, when it changes to the dormant chrysalis state. The adult beetle emerges from the chrysalis about a fortnight later, eats a hole through the bark with its strong jaws, and comes forth to continue the propagation of the species. Thus three years are required for the development of the insect.

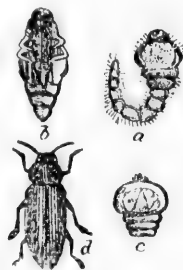
The place where the larva enters may frequently be detected, especially in young trees, by the sawdust-like castings that are pushed out. The eggs also may often be seen, and are easily destroyed by pressing on the bark surrounding with a knife-blade or some similar instrument. The presence of the larva is shown later by the discolouration of the bark where it is at work.

It is about an inch long, wholly without feet, whitish, with a chestnut brown head and black jaws. The pupa or chrysalis is lighter coloured than the larvæ, and has numerous small spines on its back.

The injuries of this insect may be prevented by applying late in May, or early in June, and twice later at intervals of three weeks, with a strong solution of soft soap, to which has been added a little crude carbolic acid. This mixture may be conveniently

Remedies.

made by mixing one quart of soft soap, or about a pound of hard soap, with two gallons of water, heating to boiling, and then adding a pint of crude carbolic acid. It will be made more effective and permanent by the addition of a small amount of Paris green and lime. The solution should be thoroughly applied (a scrub brush is excellent for the purpose) to the trunk and larger branches of the tree. If the bark of the tree is especially rough, it should be scraped before the wash is applied, and the soil should be smoothed down about the base of the trunk, so that there will be no cracks for the insects to enter to deposit their eggs. Of course, the object of this application is to prevent the laying of the eggs from which the grubs hatch. As additional precaution, it is well to examine the trees during the late summer and early autumn months for eggs and young grubs, which are readily detected, and can easily be destroyed with a knife. In this way one man can go over an orchard of five hundred or more young trees in a day.



FLAT-HEADED APPLE-TREE BORER (*Chrysobothris femorata*).

(a), shows larva; (b), chrysalis; (c), primary stage; (d), the perfect insect.

This insect is very different, both in its adult and larvæ stages, from the one just discussed. The adult beetle, instead of being cylindrical in form and brown in colour, is flattened and greenish-black. It appears, however, at about the same season as the other, and the life histories of the two species are in general much alike, the principal difference being that the present species requires less time to develop, and attacks the tree higher up, being found all the way up the trunk, and frequently in the larger branches. The front end of the larva is enlarged and flattened, while

**Flat-headed
Apple-tree
Borer.**

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the rest of the body is much narrower, and tapers slightly towards the posterior extremity. It is of a pale yellow colour, and has no feet. The pupa is at first whitish, but becomes darker as the beetle develops. As noted above, the adult beetle is of a shining greenish black colour, and has short stout legs. It may often be seen basking in the sunshine in summer, on the sides of the trees and logs. The eggs of this insect are deposited early in summer in crevices, and under the scales of the bark, being fastened in place by a glutinous substance. In a few days the larva hatches and bores through the bark to the sapwood, in which it cuts broad, flat channels, and sometimes completely girdles the tree. As it develops it bores farther into the solid wood, and when fully grown again approaches the surface. When ready to become a pupa, it gnaws partially through the bark, and then casts its last larval skin. About a fortnight later the pupa changes to a beetle, which gnaws its way through the bark, and thus completes the cycle of development.

Remedies.

The directions given above for the round-headed borer are also applicable to this insect.

The Small Bark Borers (*Magdalis anseriens*), identified by Dr. Fletcher, are reported from all parts of the Lower Mainland, especially injurious on Vancouver and other islands.

They are the larvæ of small beetles of the weevil family (*Curculionidae*).

The Small Bark Borer.

The larvæ are found under the bark of apple trees, destroying the inner bark and young wood, usually several close together; sometimes they are so numerous that the entire bark of the trunk and principal limbs is infested with the larvæ, and for all practical purposes the tree is valueless and had better be destroyed.

The methods advised to prevent the ravages of the larger borers are advised to be used as preventives; and as it is usually noticed that trees in an unthrifty condition are particularly liable to be attacked, measures should be taken by drainage, cultivation and manuring to induce a vigorous healthy growth of the trees.

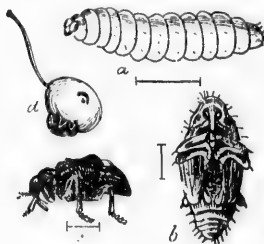
The Pea Weevil (*Bruchus pisi*) is reported from Foster's Bar and Lytton. The parent beetle deposits eggs on the outsides of the young pea-pods in summer. These hatch in a few

Pea Weevil. days, and the larvæ bore through the pods into the peas, which they enter and eat out the substance of, leaving the germ, however, untouched. When full-grown, the larvæ eat holes on one side of the pea, leaving only the outer covering, before entering the pupal state. Most of these remain in the peas till the following spring, emerging as the perfect beetle; but some complete their life cycle the same season.

Seed peas infested with these pests should be enclosed in tight vessels, and a little bisulphide of carbon poured in, covering up closely. The fumes will destroy them. Another plan has also been tried with good effect; this is to heat the peas, as soon as ripe, to a temperature of 145° Fahrenheit, when the partially grown larvæ will be killed without injuring the germinating quality of the seed.

On no account should peas infested with weevils be sown without treatment.

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THE PLUM CURCULIO (*Conotrachelus nenuphar*—Herbst).

The different stages are shown in the engraving above: (a) represents the grub much magnified; (b) the chrysalis, and (c) the beetle, both magnified; (d) the young fruit, showing the crescent-shaped mark made by the insect, and the curculio, life size, at its work.

So far as known, this pest of plum growers in Eastern States and Provinces does not occur in British Columbia, but it is advisable that our fruit-growers should know the appearance of the insect. It belongs to the family of snout beetles, so called from the shape of the head, which is elongated into a beak. The beetle is a small, rough, grayish insect, about one-fifth of an inch long. The female deposits eggs in the young fruit of plums and cherries, causing them to drop prematurely, generally before the larvæ are full grown.

The
Plum Curculio.

The Imported Currant Borer (*Sesia tipuliformis*) is reported from New Westminster, Burnaby, Vancouver, Vernon and Victoria. In the injurious stage of its existence this insect

Imported
Currant Borer.

is a small whitish larvæ that burrows up and down the stems of currant and gooseberry bushes, stunting the growth and rendering them unfruitful. It hatches from eggs deposited singly on the young stems near the buds, early in summer, by a clear-winged wasp-like moth, with a bluish-black body and three yellow bands across the abdomen. The wings are transparent except at the borders, where they are brownish black. The young larvæ gnaw through the stem to the centre, where they feed on the pith all summer, making a burrow several inches in length. When full grown the larvæ eat through the stem wall almost to the outside and then change to chrysalides. When these are ready to transform, they burst through and the moths crawl out. So far only one brood has been noticed in the year.



Parent Moth.

All dead and weak shoots of infested bushes should be cut off and burnt, just as soon as leafing out shows where the attack is located, and every wilted shoot seen at any time should be cut off below the point affected and burnt. Another preventive measure which has been found effective by Mr. M. J. Henry, is to sprinkle the bushes and the ground adjacent with a mixture of air-slacked lime and carbolic acid, at the time when the parent moth is active, usually about the middle of May to the first week in June, varying somewhat with the locality.

Remedies.

The Raspberry Cane Borer (*Othrea bimaculata*) is reported from New Westminster, Hall's Prairie, and Victoria.

The adult of this insect is a slender-bodied, black beetle, with a yellow collar just behind the head. It appears early in summer, usually during June in the Northern States, and deposits eggs in the green canes of raspberries and blackberries. The process of oviposition is peculiar. The beetle makes two transverse rows of punctures, about half an inch apart, in the cane; towards the tip and midway between these she deposits the egg. The rows of punctures make up a kind of girdling, which causes

Raspberry
Cane Borer.

the tip of the cane to wither. A short time after the egg is deposited it hatches into a small cylindrical larva, that bores downwards through the pith. By autumn they have frequently reached the bottom of the cane, where they change to pupæ, and the following June emerge again as beetles. The larva is footless.

Soon after the canes are punctured by the beetle they wilt; consequently, if they are examined about midsummer, affected canes can easily be distinguished, and they should then be cut off below the lower ring of punctures and burned. If the injury is

Remedies. noticed later, the whole cane should be pulled up and destroyed, to be sure and get the larva.

This pest (*Bombicia marginata*) has become very prevalent in the vicinity of Victoria, where it has wrought great damage to the raspberry canes. It is not reported from other parts of the Province. It is quite distinct from the cane-borer, having in the larval

Raspberry Root Borer. state sixteen legs, six of which are fully developed, the others not being very well defined. The parent moth is clear-winged, with a black body, prettily

banded and marked with yellow. The eggs are deposited in July on the leaves of the raspberry, and the young larvæ, when hatched, find their way to the canes and feed upon the pith in the interior, gradually working down to the root, where they winter. In the following spring they work up again, usually through a fresh cane, to a height of six inches or more above ground, and eat the cane nearly through, in preparation for the exit of the future moth. Within the cane and near this prepared spot the change to chrysalides takes place, and these, when the time approaches for the moth to escape, burst through the outer skin of the canes, and the moths soon take their flight and commence to lay their eggs, as previously stated.

Little can be done towards the destruction of this pest, other than destroying the infested roots as soon as they are noticed. The application of boiling water to infested roots is advised by a California writer.

Westminster,
see this insect



Parent Moth.

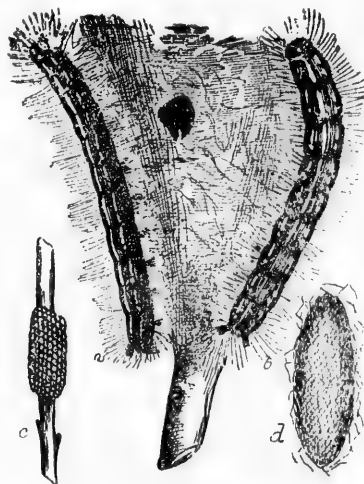
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THE APPLE-TREE TENT CATERPILLAR (*Elisioctenura*).

(a), Side view; (b), back view, full grown at about six weeks old; (c), cluster of eggs; (d), cocoon, oval of pale yellow colour.

Three varieties of these pests of the fruit-grower have been identified in the Province, differing somewhat in appearance, but having the same destructive habits, and well known by

Tent Caterpillars.

their habit of building webs or nests from which they issue to feed. The eggs of these pests are deposited upon the twigs of fruit and other trees in ring-like clusters or patches and covered with a viscid liquid, which dries into a sort of varnish, by the parent moths; this takes place during July and August.

On the principle that an ounce of prevention is worth a pound of cure, the easiest way of dealing with this pest, especially on small trees, is to destroy the egg masses, either removing them for the purpose, or cutting off the twigs on which they are found.

How to Deal with them.

Careful searching is required to do this, but the work can be accomplished in the dormant season, when there is not so much press of work in other ways. If the caterpillars are allowed to hatch out, they are easily detected by their conspicuous web or nest. In the early and late portions of the day they will all be found in these nests, and can be readily destroyed by crushing the nests and their contents with the gloved hand, by trampling under foot, or by using a torch to burn them out. Sometimes when a nest has been destroyed some of the caterpillars will be absent feeding, and within a few days the nest will be repaired and the remnants of the colony re-established, so that repeated visits should be made to the orchard in order that all may be destroyed. Neglected trees are soon stripped of their foliage and become exhausted by having to reproduce foliage at an unseasonable time, so that little or no fruit will be produced the following season.

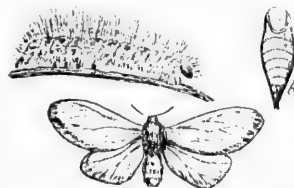
Where these pests have been neglected till they become mature, it may become necessary to use the Paris green spray (No. 9) to prevent them from spreading. As egg clusters are very numerous this season, we may expect that the pests will give considerable trouble during the summer, and fruit-growers should be on the alert to reduce the number as far as possible by destroying them.

Fall Web-Worm (*Hyphantria textor*) is reported from Chilliwack and the Spallumcheen Valley. The moth of this species deposits her eggs in broad patches on the under side of the leaves, near the end of a branch, during the latter part of May or early June.

Fall Web-Worm. These hatch during June and July. As soon as the young larvæ appear they begin to eat and to spin a web over themselves for protection. They devour only the pulpy portion of the leaves, leaving the veins and skin of the under surface untouched. When full grown they are an inch or more in length, and vary greatly in their markings; some examples are pale-yellow or greenish, others much darker, and of a bluish-black hue. The head is black, and there is a broad, dusky or blackish stripe down the back, along each side is a yellowish band, speckled more or less with black. The body is covered with long straight hairs, grouped in tufts, arising from small black or orange-yellow protuberances, of which there are a number on each segment.

The moth is of a milk-white colour, without spots. When expanded, the wings measure about 1½ inches across. From their birth the web-spinning habits of the larvæ promptly leads to their detection, and as soon as seen they should be removed by cutting

The Remedy. off the twig or branch and destroying it. As they remain constantly under the web for so long a period, the removal of the branch insures in most instances the destruction of the whole colony. See also remedy recommended for Apple-Tree Tent Caterpillar.



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The larvæ of the Tussock Moth (*Orgyia antiqua*), identified by Dr. Fletcher, are reported from Victoria, New Westminster and adjoining districts—feeding upon the leaves of fruit and other trees. When mature, the caterpillars are very pretty, having bright

Tussock Moth. red heads, and yellowish bodies, bearing a series of dense, abruptly cut-off brushes on the middle of their backs, with two pencils of black hair on the anterior, and one on the posterior of each.

The eggs from which the caterpillars hatch are often noticed in winter on dead leaves which are fastened to the trees, with usually the empty cocoon attached. The injury from these pests is best prevented by the destruction of these egg masses during the winter.

The caterpillars may be killed by using the Paris green spray, or, if not too numerous, picking might be resorted to.

This insect (*Plutella cruciferarum*), the enemy of cabbages and allied plants, is reported from Duncan's and Burgoyne Bay, and is probably present to a greater or less extent in adjoining districts. The caterpillars are green in colour, and about $\frac{1}{4}$ inch

The Diamond-Back Moth. in length, and very active; they eat holes through the young leaves and the under surface of older leaves of their food plants. When disturbed they run backwards, wriggling their bodies violently from side to side, and fall to the ground by means of a silken thread, where they lie quite still.

The moth is very variable in size and colour—the general colour being ashy-gray, with a light stripe of somewhat diamond-shaped marks on the back, more or less distinct, though sometimes wanting. The upper wings are freckled with black dots and small blotches of yellowish scales.

There are two or three broods of this insect during the season.

Hellebore gives good results against this pest, used either dry or as a spray, but Dr. Fletcher reports better results from the use of kerosene emulsion. A plentiful use of water to keep plants in a thriving condition, is also a good means of dealing with the

Remedies. pest, which thrives especially well in dry seasons. Being remarkably subject to the attacks of parasites, it is seldom troublesome during successive seasons, periodical attacks being the rule.

The Red-humped caterpillar (*Eudemasia concinna*) is reported from Lytton and Chilliwack, feeding upon the foliage of apple and other fruit trees.

The head of this caterpillar is red, and there is a hump on its back of the same colour, on the fourth ring or segment; the body is marked lengthwise by slender black, yellow and white lines, and has two rows of black prickles along the back and other shorter ones upon the sides, from each of which there arises a fine hair.

Red-Humped Caterpillar. The hinder segments taper a little, and are always elevated, when the insect is not crawling. It measures, when full grown, about $1\frac{1}{4}$ inches in length.

The caterpillars feed together in numbers, usually stripping the branches of leaves as they proceed. When handled, they emit a transparent fluid having a strong acid smell. When full grown they descend to the ground and conceal themselves under leaves or slightly below the surface, after a time changing to brown chrysalids.

The moths usually appear about June, and are described as follows:—The fore-wings are dark brown on the inner and grayish on the outer margin, with a dot near the middle, a spot near each angle, and several longitudinal streaks along the hind margin, all dark brown.

The hind wings of the male are brownish, or dirty white; those of the female dusky brown. When expanded, the wings measure 1 to $1\frac{1}{4}$ inches across.

The female deposits her eggs in a cluster on the under side of a leaf; these soon hatch into small caterpillars, which at first feed on the substance of the under side of the leaf; later on they consume the entire leaves. When not eating, they remain close

Easily Destroyed. together, sometimes completely covering the branch they rest upon. On account of this habit they can be easily gathered and destroyed, or the limb cut off and trampled under foot. They are also easily destroyed by using the Paris green spray, No. 9.

The Mottled Umber Moth (*Hibernia defoliaria*) is reported from Victoria and the surrounding district as injurious to the foliage of fruit-trees, especially plums and cherries. The larvae are slender loopers or measuring worms, $1\frac{1}{4}$ inches in length, with chestnut red heads, dark reddish-brown backs, mottled with broken narrow black lines, the lowest distinct and waved; the sides bright yellow, paler beneath. There is a dark reddish patch shaded with black, surrounding each spiracle. The male moth is of a dull ochre-brown hue, expanding $1\frac{3}{4}$ inches, and has the upper wings dotted and crossed diagonally by two dark waved bands; the space between these is pale and bears on each wing a dark discal spot; the lower wings are paler than the upper, and like them sprinkled with brown dots, and they have a dark spot near the middle. The female moth is brown, with two rows of conspicuous spots down the back. The wings are almost entirely aborted. When the moths appear in the autumn, the females crawl up the trunks of trees and lay their eggs on the branches. In this condition the insect passes the winter.

The usual remedies for the canker-worms are applicable for this species, and consist of tying sticky bandages or mechanical contrivances around the trunks of fruit trees to prevent the females from crawling up to deposit their eggs, or what will be found far more effective, spraying the trees in spring when the young caterpillars hatch, with Paris green and lime, 1 pound of each to 200 gallons of water.

Remedies.

The Bud Moth or Worm (*Thetocera ocellana*) is reported from Okanagan, Nanaimo, Victoria, and Ladner's Landing.

As soon in spring as the buds begin to open, the little caterpillars may commence work upon them, gnawing the miniature leaves and blossoms, but the attack is more likely to begin after the buds are about half open.

Bud Moth.

The larvae then eat out the centres of the buds, where the leaves and flowers are least developed. The caterpillar forms for itself a protecting case, by using silken threads to bind together the leaves. As the season advances some of the leaves are killed, become detached at the base, and turn brown; the blossoms also are more or less webbed. The life history of this insect may be summarized as follows:—The moths appear in the orchard early in summer; during daylight they rest upon the bark of trees or other shelter; at night they fly about and deposit their eggs, one in a place on the underside of the leaves. About ten days later these eggs hatch into small green larvae, which feed upon the epidermis of the leaves, each making for itself a silken tube and a thin layer of silk for protection and concealment. In a day or two the green colour changes to brown.

As the larva increases in size and the area over which it feeds becomes larger, the tube is enlarged and lengthened along the mid-rib, sometimes becoming nearly one inch in length. The silken web under which the larva feeds covers the entire field of operations, but is so thin near the edges where the larva has last fed as to be scarcely visible. The excrement of the larva being retained by the web, appears as little black pellets scattered here and there over the feeding ground. The green portion of only one side of the leaf is eaten, the veins and veinlets being left untouched; these and the green on the opposite side die and turn brown, and thus become conspicuous. Late in summer, or early in autumn, the half-grown caterpillars desert the leaves and crawl upon the twigs, where they form little silken cases, generally near the buds or in creases in the bark. In these they remain throughout the winter. The following spring they emerge to feed upon the opening leaves. They again make tubes, which serve as protective cases. After feeding six or seven weeks they become full grown; then they form silken cocoons, generally in a rolled leaf or between two leaves, in which they change to pupae, to emerge a short time later as moths. The full-grown larvae are cinnamon brown in colour, with the legs, head and shield behind dead black. They are about half an inch long and of the general form. The moth has a general resemblance to the common codlin moth. It is dark ashen gray, with creamy white blotches on the front wings, which expand a little more than half an inch.

These little pests can most successfully be destroyed by spraying with the arsenites early in spring, when the buds are opening and the larvae just beginning the season's work. It is

advisable to use the Bordeaux mixture and Paris green combination, in order to prevent injury by apple scab or other fungus maladies, as well as by insects. (See Spraying Mixtures.)



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The Oblique-Banded Leaf Roller (*Cacaecia rosaceana*) is reported from Victoria, injuring the buds and young leaves of apple and other fruit trees. This moth is a member of the Tortricidae or leaf-rollers, so named on account of their habit of rolling up

Leaf-Roller. the leaves or portions of them into hollow cylinders, within which they live and feed. The larvae commence operations as soon as the buds begin to expand; when full-grown they are about three-quarters of an inch in length, of a green or yellowish green colour, with the head and top of the first segment brown; there is usually a darker stripe along the back, and a few smooth dots on each segment, from each of which arises a fine short hair.

The ravages of the larvae are often quite serious, as they check the new growth and destroy the blossoms. Spraying, to be effective, requires to be done early in the season, using the Paris green spray. After the cases are formed, hand-picking and crushing of these is advised.



CODLIN MOTH.

(*Carpocapsa pomonella*.)

The puncture made by the moth is represented at (b), the borings of the larva at (a), the mature worm at (c), the moth with wings closed at (f'), the moth with wings expanded at (g), and the cocoon at (i); (d), the chrysalis, and (h), the anterior part of the body magnified.

(a), Nest of larva on outside of tree, under the old bark; (b), pupa; (c), larva exposed from nest; (d), old nest; (e), larva about to build nest; (f), the moth at rest; (g), moth with wings spread; (h), head of larva.

This pest (*Carpocapsa pomonella*) continues to be reported from different portions of the Province, and although no specimens have been as yet positively identified as occurring on fruit grown in the Province, larvae have been found in apples which at least are very similar in appearance. Codlin moth appears in infested pears and apples as a reddish white grub or worm. The larva is whitish when young, but becomes pinkish or flesh coloured as it approaches full growth. When young the head is blackish, but in the full grown larva it is brown, with darker markings along the sutures. The shield on the back of the first segment is of the same colour as the head. The body is furnished with a few very small hairs, which arise from minute elevated points, of which there are eight on each segment, two on the back, each side of the middle line, and a somewhat larger one above and below each spiracle. The full-grown larva is $\frac{3}{4}$ of an inch in length. The cocoon is white inside and grayish outside, usually covered somewhat with bits of bark or minute fragments of whatever substance the worm happens to spin on. The enclosed pupa is yellowish brown, with rows of minute teeth on the back of the abdomen. The moth is grayish brown in general appearance, but examined closely, we see that the fore wings are marked with alternate irregular transverse streaks of gray and brown, and that there is a large rounded tawny spot on the outer hind angle. This spot is marked with streaks of bronze or gold and there are similar streaks just above it. The hind wings are brown, grading from light to dark from base to tip. The two sexes can be distinguished by a black pencil of

**Codlin Moth or
Apple Worm.**

hairs on the upper surface of the hind wing of the male only. The "pencil" is not easily distinguished but is always present. It runs in a furrow, which is visible from the under side as a slight keel.

Observations made during the past season by Prof. Slingerland have demonstrated that the eggs of the codlin moth are not deposited in the calyx of the fruit, as has been the generally accepted belief, but are usually laid on the side of the fruit. The eggs

The eggs.

are a little smaller than the head of a pin, are flattened and transparent, so that the colour of the apple shows through them. Under the microscope the surface of an egg is seen to be marked with lines, and it looks somewhat like a fish scale. Careful observation in orchards by Prof. Slingerland showed hundreds of eggs, scattered anywhere over the surface of the fruit, sometimes several on one fruit. As observed in the insectary, the worm, which at first was little larger than a hair, was hatched in about ten days, and remained on the surface of the apple for several hours after emerging from the egg. It then crawled about until the calyx of the fruit was reached, where it worked its way between the lobes and entered the cavity. Here it remained for a number of hours, eating the surface of the calyx lobes, and then gnawed its way into the apple. It will be seen from what has been related, that the practice of spraying the trees with Paris green as soon as the blossoms fall, which has been found effectual by practical growers, is entirely rational. At this time the calyx lobes are open, and the Paris green will be readily deposited in the eye, the fruit being turned upwards, and the poison will be eaten by the larva when it hatches 10 days or so later on. The closing of the calyx is also of advantage, as it covers the eye and prevents the washing out of the Paris green by heavy rains. There are two or more broods of the insect during the season.

Usually the castings from the larva are pushed out through the hole by which it has entered, the passage being enlarged from time to time for this purpose. Some of the castings

Development Stages.

commonly adhere to the apple, hence before the worm is full grown, infested fruit may generally be detected by the mass of reddish-brown exuvie protruding from the eye. Sometimes as the larva approaches maturity, it eats a passage through the apple at the side, and out of this opening it thrusts its castings, and through it the larva, when full grown, escapes. In three or four weeks from the time of hatching the early brood of larvæ attain full growth, when the occupied apples generally fall prematurely to the ground, sometimes with the worm in them, but more commonly after it has escaped. The larvæ which leave the apple while still on the trees, either crawl down the branches to the trunk of the tree, or let themselves down to the ground by a fine silken thread, which they spin at will. In either case, whether they crawl up or down, the greater portion of them find their way to the trunks of the trees, where, under the rough bark, and in cracks and crevices, they spin their cocoons.

Having selected a suitable hiding-place, the larva constructs a papery-looking, silken cocoon, which is white inside, and disguised on the outside by attaching to the silky threads small fragments of the bark of the tree or other available debris.

After the cocoon is completed, the change of the chrysalis takes place in the early brood in about three days. At first the pupa is of a pale yellow colour, deepening in a day or two to a pale brown. The insect remains in this condition about two weeks, when the moth escapes.

Each moth is capable of laying on an average probably not less than fifty eggs, but these are not all matured at once. By careful dissection they may be found in the body of the moth in different stages of development. Hence they are deposited successively, extending over a period probably of from one to two weeks or more. Add to this the fact that some of the moths are retarded in their development in the spring, and it is easy to account for the finding of larvæ of various sizes at the same time; indeed, sometimes the later specimens from the first brood will not have escaped from the fruit before some of the young larvæ of the second brood make their appearance, the broods thus, as it were, overlapping each other and very much extending the period for the appearance of the winged insects.

The moth conceals itself during the day-time and appears only at night, and since it is not readily attracted by light is seldom seen. The second brood of moths are usually on the wing during the latter half of July, when they pair, and in a few days the female begins to deposit her eggs for the later brood of larvæ, generally selecting for this purpose the later apples. These larvæ mature during the autumn or early winter months. If they escape before the fruit is gathered, they seek some sheltered nook under the loose bark of a tree, or other convenient hiding-place; but if carried with the fruit into the cellar, they may often be

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found about the barrels and bins in which it is stored. A favourite hiding-place is between the hoops and staves of the apple barrels, where they are found sometimes by hundreds. If thus provided with snug winter quarters, and through negligence allowed to escape, the fruit grower must expect to suffer increased loss for his want of care.

Having fixed on a suitable spot, the larva spins its little tough cocoon, firmly attached to the place of attachment, and within this it remains in its larval state until early the following spring, when it changes to a brown chrysalis, and shortly afterwards the moth appears to begin the work of the opening season.

The moth is a night flier, but is not readily attracted by light, and is so seldom captured by poisoned baits as to render this method of destruction impracticable.

One of the most effective methods yet devised for reducing the number of this insect is to trap the larvæ and chrysalides and destroy them. This is best done by applying bands

Remedies around the trunks of the trees, about six inches in width; strips of old sacking, carpets, cloth, or fabric of any kind will serve the purpose, and

Trapping. although not so durable, many use common brown paper. Whatever material is used, it should be wound entirely around the tree once or twice, and fastened with a string or tack. Within such enclosures the larvæ hide and transform. The bands should be applied not later than the first of June, and visited every eight or ten days until the last of August, each time taken off and examined, and all the worms and chrysalides found under them destroyed; they should also be visited once after the crop is secured. Some persons prefer to use narrower bands, not more than four inches wide, and fasten them with a tack, while others secure them in their place by merely tucking the ends under. Usually the cocoons under the bandages are partly attached to the tree and partly to the bandages, so that when the latter is removed the cocoon is torn asunder, when it often happens that the larva or chrysalis will fall to the ground, and if it escapes notice may there complete its transformations.

Paris green has been found the best poison to use, either in combination with lime or with

Spraying. Bordeaux mixture, at the rate of 4 ozs. to 50 gallons of water or Bordeaux mixture. If water is used in diluting, add 2 lbs. fresh lime to each 50 gallons. See spray No. 9.

Under favourable circumstances a single spraying is sufficient, but usually two sprayings are required at intervals of about a week, and a third if rain interferes. The first spraying should always be made as soon as the blossoms have fallen and the fruit is set. The second spraying is made to allow for the irregular hatching of the larvæ, and to make certain that all are reached. To be efficient, the spray must reach every fruit to be protected.

The fallen fruit should be promptly gathered and destroyed. It has been recommended that hogs be kept in the orchard for the purpose of devouring such fruit, and where they can be so kept without injury to the trees or other crops, they would no doubt be useful.

Canker or Measuring Worms (*Anisopteryx*—undetermined) are reported as injuring the foliage of fruit trees at Nanaimo and Victoria. The caterpillars feed upon the pulp of the leaf, leaving the network of veins, so that the foliage appears brown and scorched.

Canker Worms. There are two distinct species. They are, when full grown, about an inch in length, and vary from a greenish-yellow to a dark brown colour, with broad yellowish or paler stripes along each side. When not eating they usually assume a stiff posture, either flat and parallel with the twigs on which they rest, or at an angle of about forty-five degrees.

The two sexes of these canker worm moths differ greatly. The male has large, well developed wings, while the female is wingless. When she emerges from the chrysalis state she crawls to the base of the tree, and ascends the trunk some distance; here the male finds her, and after mating she begins the deposition of eggs.

This habit gives control of these pests, for if we simply band the trees in such a way as to prevent either the female or the young caterpillars from ascending the branches, they will be completely protected. Unless the females can get upon the leaves, the eggs are laid upon the trunk below any obstruction they cannot pass. The young larvæ will attempt to get to the leaves, and will, if they find an impassable barrier, starve to death.

Prof. J. B. Smith recommends the use of "dendrolene" for the purpose, as it remains in a viscid condition for a long time. It should be applied on a band of thick wrapping paper put round the trunk, about six inches wide, and spread a quarter of an inch in thickness over the wrapping paper. Tar mixed with oil to prevent its drying, may be used in the same manner, or printer's ink, if the first-named substance is not available, but to be effective must be kept sticky by frequent renewal. Fluffy wool or cotton banded round the tree has also been used with good results, but is not so certain a preventive.

Infested trees should be sprayed with Paris green (*see* Spray No. 9) soon after the worms hatch.

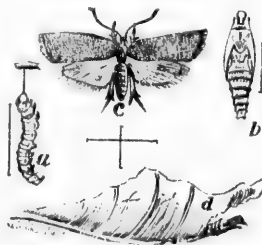
The name Apple Fruit Miner has been given to a small larva of one of the tortricid moths. It feeds upon the pulp of the apple, tunnelling through it in all directions, completely spoiling the fruit, when, as is often seen, several larvæ are present in one apple.

This pest was very plentiful in Chilliwack and Mission City Districts the past season, which is the first in which the ravages of the insect have attracted much attention, though it has been noticed occasionally in previous years. It is also reported from parts of Vancouver and other islands, and is apparently widely distributed, though until the past season not noticed to any extent.

Its life history has not yet been worked out. Mr. E. A. C. Gibson, of the Department of Agriculture, is, however, making a special study in this line.

So far the only practical way of dealing with the pest, which suggests itself, is the destruction of all infested fruit, and this should be carefully attended to. A thorough cleaning of the orchard, and the burning of all prunings and other rubbish is also recommended.

It is probable that this is a native insect, as it is found in large numbers on the fruit of the wild crab, so that its natural enemies may be expected to help the fruit-grower in dealing with the pest.



THE LESSER APPLE-LEAF ROLLER.

(a) Larva. (b) Pupa. (c) Moth. (d) Folding case of leaves.

The caterpillar of the Lesser Apple-leaf Roller (*Teras minuta*) is a greenish-yellow larva, smooth, with a pale brown head and whitish markings, affecting the young leaves of the terminal twigs, with which the insect forms a protective case. This species is remarkable in that two of the three broods of moths which appear during the year are of a bright orange colour, while those of the third brood are reddish gray. It is an example of what naturalists call dimorphism.

The eggs are laid in the spring, on the unfolding leaves of apple and other trees and bushes, the larvæ soon hatching and feeding on the young foliage, some of which they roll into a protective covering.

Here they continue feeding for about a month, when they pupate within the folded leaves, and a week or so later emerge as small orange yellow moths. These moths lay eggs for another brood of larvæ, the moths of which are also yellow, and they in turn lay eggs for a third brood, which develops in the fall as reddish gray moths. These winter in sheltered places and in the following spring deposit their eggs as previously stated.

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This pest must be closely watched, as spraying to be effective should be done when the caterpillars are quite young, before they form protecting cases of the leaves.

Either Paris green or hellebore can be used effectively against this pest, preferably the first-named. (See sprays 8 and 9.) Other varieties of leaf rollers are also reported as

Remedies. injuring fruit trees, which are not yet identified. However, the remedies mentioned should be used to destroy them, always taking care to spray before the "protecting cases" are formed.

This insect (*Papilio asterias*) is reported from Nanaimo and Victoria; it feeds upon the foliage of vegetables of the parsley family, celery, carrot, parsnip, etc. The caterpillars are very handsome and conspicuous in appearance; the general colour is pale green, with a series of transverse bands of black and yellow markings on their bodies. When irritated they thrust out, from a slit just back of the head, a pair of peculiar yellow y-shaped organs that emit a disagreeable odour, which, no doubt, is intended to serve as a protection from enemies. The eggs of this insect are deposited upon the undersides of the leaves of its food plants.

Celery Caterpillar. The adult butterfly is a handsome black insect with yellow and blue markings on the wings. When young, the caterpillars may be destroyed by using hellebore or buhach, applied as for the currant worm, but usually hand picking will keep them in check, as they do not occur in great numbers.

Reported from Enderby, Sooke, Beaver Point, Victoria, Ashcroft, Bonaparte, and James Island, and no doubt common in many other districts. As a preventive measure, the bushes and ground adjacent should be sprinkled with a mixture of air-slacked lime and carbolic acid, just at or previous to the time when the parent fly is active, probably early in May. One pint of crude carbolic acid to one bushel of lime, well-mixed together, is strong enough for the purpose. This method is useless after the eggs have been deposited, *so careful attention is necessary.* Affected fruit ripens prematurely and drops to the ground. These and the rubbish from under the bushes should be gathered and burnt.



IMPORTED CURRANT WORM or CATERPILLAR
(*Nematus ventricosus*.)

The full-grown worms are about three-fourths of an inch long, and are shown at (a); (b) gives the position of the black spots upon a magnified joint of the body.



FEMALE FLY.

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This well-known pest, which feeds upon the leaves of gooseberry and currant bushes, is reported from most districts of the lower Province. Its parent is a member of the saw-fly family.

**Imported
Currant Worm.**

It is a four-winged fly, with a rather deep, yellow body, and may often be seen in spring sitting upon the foliage or flying about, when the leaves of the bushes are developing. It deposits its eggs on the principal veins of the undersides of the lower leaves. The larvæ soon hatch and commence to feed ravenously; bushes sometimes are completely stripped of their leaves in a few days. There are two or more broods in the course of the season, so that special care should be taken not to neglect the first. The larvæ is green, dotted with black spots, when full grown, nearly an inch in length; when mature they spin their cocoons beneath the leaves and rubbish at the surface of the ground, within which they pupate. The cocoons are brown in colour, and not easily distinguished from the soil and leaves.

Hellebore has been found the best remedy for this pest. It may be used in the form of a dry powder, or in water as a spray, at the rate of 1 oz. to 2 gallons water. On a large scale

**The Best
Remedy.**

Leggett's Powder Gun is a very quick and economical means for applying dry hellebore; by its use there is a great saving of time in the application as well as material, one large grower stating that three-fourths of the labour and expense can be saved by its use over the method of distributing the powder by other means, and this statement is fully borne out by experiments made by the writer the past season.

If desired, Paris green mixed with dry flour, at the rate of 1 oz. to 4 lbs. flour, can be used to dust the bushes for the early brood, or as a spray (*see* Spray No. 9), but would not be advisable for later use, when fruit is on the bushes.

In fighting this pest care should also be taken to commence when the pests are quite small, and found on the lower portions of the bushes, and so reduce the labour and expense to a minimum.

This pest is found to a greater or less extent all through the fruit-growing districts of the lower Province, but is not reported from the interior. Pear and cherry trees

**Pear and Cherry
Slug.** in New Westminster District especially have been very much injured by the pest.

This insect passes the winter in the pupa state under ground; the flies, the progenitors of the mischievous brood of slugs, appearing on the wing about the third week in May until the middle of June. The fly is of a glossy black colour, with four transparent wings, the front pair being crossed by a dusky cloud; the veins are brownish, and the legs dull yellow, with black thighs, except the hind pair, which are black at both extremities, and dull yellow in the middle. The female fly is more than one-fifth of an inch long; the male is somewhat smaller. When the trees on which these flies are at work are jarred or shaken, or if the flies are otherwise disturbed, they fall to the ground where, folding their antennæ under their bodies and bending the head forward and under, they remain for a time motionless.

The saw-flies have been so called from the fact that in most of the species the females are provided with a saw-like appendage at the end of the body, by which slits are cut in the leaves of the trees, shrubs, or plants on which the larvæ feed, in which slits the eggs are deposited. The female of this species begins to deposit her eggs early in June; they are placed singly within little semicircular incisions through the skin of the leaf, sometimes on the under side and sometimes on the upper. In about a fortnight these eggs hatch.

The newly-hatched slug is at first white, but soon a slimy matter oozes out of the skin and covers the upper part of the body with an olive-coloured sticky coating. After changing

**The Pest De-
scribed.**

its skin four times, it attains the length of half an inch or more, and is then nearly full grown. It is a disgusting-looking creature, a slimy, blackish, or olive-brown slug, with the anterior part of its body so swollen as to resemble somewhat a tadpole in form, and having a disagreeable and sickening odour. The head is small, of a reddish colour, and is almost entirely concealed under the front segments. It is of a dull yellowish colour beneath, with twenty very short legs, one pair



PEAR AND CHERRY SLUG.
(*Selandria ceris*.)

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under each segment except the fourth and the last. After the last moult it loses its slimy appearance and dark colour, and appears in a clean yellow skin entirely free from slime. Its form is also changed, being proportionately longer. In a few hours after this change it leaves the tree and crawls or falls to the ground, where it buries itself to a depth of from one to three or four inches. By repeated movements of the body the earth is pressed firmly on all sides, and an oblong oval chamber is formed, which is afterwards lined with a sticky, glossy substance, which makes it retain its shape. Within this little earthen cell the insect changes to a chrysalis, and in about a fortnight finishes its transformations, breaks open the enclosure, crawls to the surface of the ground, and appears in the winged form.

About the third week in July the flies are actively engaged in depositing eggs for a second brood, the young slugs appearing early in August. They reach maturity in about four weeks, then retire underground, change to pupae, and remain in that condition until the following spring.

Pear and cherry growers should be on the look-out for this destructive pest about the middle of June, and again early in August, and if the young larvae are then abundant they should be promptly attended to, since, if neglected, they soon play sad havoc with the foliage, feeding upon the upper side of the leaves and consuming the tissues, leaving only the veins and under skin. The foliage, deprived of its substance, withers and becomes dark coloured, as if scorched by fire, and soon afterwards it drops from the trees. In a badly infested pear orchard whole rows of trees may sometimes be seen as bare of foliage during the early days of July as they are in midwinter. In such instances the trees are obliged to throw out new leaves, and this extra effort so exhausts their vigour as to interfere seriously with their fruit-producing power the following year. Although very abundant in a given locality one season, these slugs may be very scarce the next, as they are liable to be destroyed in the interval by enemies and by unfavourable climatic influences.

Spraying with Paris green or hellebore as soon as noticed. See sprays Nos. 8 and 9, or Remedies. small trees may be treated as for the currant worm, with hellebore or Paris green.



Moth.

Cut-worms (*Noctuidæ*) are reported from all parts of the Province, very destructive to garden crops. There are many different species of these well-known

Cut-worms. enemies of the garden and farm. They are

all larvæ of night-flying moths, and are rather thick, naked worms, which curl up when disturbed.



Larva.

In places where cutworms are known to be troublesome, it is advisable to fall-plough sod-land as early in the season as convenient: this will avoid egg-laying by moths of late broods. Prof. Fletcher advises the following remedies:

(1) As the young caterpillars of many species hatch in autumn, the removal of all vegetation from the ground as soon as possible in autumn deprives them of their food supply, and also prevents the late flying moths from laying their eggs in that locality. Fields or gardens which are allowed to become overgrown with weeds or other vegetation late in the autumn are almost sure to be troubled with cut-worms in the spring.

(2.) Large numbers may be destroyed by placing between the rows of an infected crop, or at short distances apart on infected land, bundles of any succulent weed, or other vegetation which has been previously poisoned by dipping it, after tying in bundles, into a strong mixture of Paris green. The cut-worms eat the poisoned plants and bury themselves and die. In hot and dry weather these bundles should be placed out after sundown, and a shingle may be placed on each to keep it from fading.

(3.) —(a.) It will be found to well repay the trouble and expense to place a band of tin around each cabbage or other plant at the time of setting out. These may very easily be made by taking pieces of tin six inches long and two and a half wide and bending them around a broom handle; the two ends can be sprung apart to admit the plant, and then the tube should be pressed about half an inch into

Banding and Wrapping.

the ground. This is a useful means of disposing of empty tomato and other cans. To prepare these easily, they need only be thrown into a bonfire, when the tops and bottoms fall out and the sides become crumpled. The central piece of tin can then be cut down the centre with a pair of shears, and forms two tubes.

(b) Wrapping a piece of paper round the stems of plants when setting out will also save a great many.

(c) Hand-picking or digging out the cut-worms whenever a plant is seen to be cut off should, of course, always be practised.

Prof. J. B. Smith says that plants such as tomatoes, cabbages, etc., can be protected when set out by putting at the base of each plant a tablespoonful of poisoned bran, using 1 lb. Paris green to 50 lbs. bran. This should be well mixed, dry, and then moistened with sweetened water until the whole is thoroughly wet, but not sloppy. This mixture is very attractive to cut-worms, being usually preferred to the plants. Against climbing cut-worms, which sometimes injure fruit trees and bushes, dendrolene or the other preventative remedies advised for canker-worms will afford protection.

There are two enemies which deserve special notice and from the good service they do should be known by sight to every cultivator. They are the



Cut worm Lion.

fiery ground beetle or cut-worm lion (*Calosoma calidum*—Fab.) and the black wasp (*Ammophila luctuosa*). Both of these are desperate enemies of the cut-worms, the former feeding on them in all of its stages; the latter digging them out and storing its nest with them as food for its young grubs.



Black Ground Wasp.

Grasshoppers and locusts (*Acrilidae*) are reported from Kamloops, Lytton, Ashcroft, Columbia Valley, Fort Steele, Nicola, Tobacco Plains, East Kootenay, Grasshoppers. Louis Creek, Adams Valley, in the interior, and from Surrey Centre, Sardis, Agassiz and Vancouver Island, in the lower country.

These grasshoppers, or locusts, are of several different varieties, the most common one in the interior probably being *Melanoplus atlantis* (Riley). Dr. Fletcher says:—

"The large amount of damage annually wrought by locusts is seldom appreciated. Their habits are to frequent grass lands, where a large proportion of the crop may be consumed without making much difference in the appearance of the fields. It is only after hay is cut, or in seasons of unusual drought, that locust injuries are much noticed. If, however, their numbers at all times and their voracity are considered, it will at once be seen that they must every year destroy much produce. They do not develop wings until July, and previous to that they pass most of their lives low down among the stems of grasses. Besides locusts, there are many other forms of grass-feeding insects which every year levy a heavy toll unnoticed.

These may all be to a large measure controlled by the use of machines called 'The use of hopper-dozer.' 'hopper-dozers,' or 'tar-pans,' which were invented in the West some years ago at the time of the so-called 'locust invasions.' Prof. Herbert Osborn, of

Iowa, writing on means of destroying grasshoppers, says:—"In meadows and pastures, we believe the use of the hopper-dozer the most practical plan that can be recommended. In many cases it can be used to capture these and the leaf-hoppers at the same time, especially if used when grasshoppers are still quite small and can be held by a thin layer of coal-tar used on the simple flat sheet of iron. When larger they need a deeper layer of coal-tar, or a pan of water with a covering of coal oil on it. A cheap and simple plan for this purpose, costing from \$1.50 to \$2, was described many years ago by Prof. Riley. It consists of a strip of sheet-iron 8 or 10 feet long, turned up 1 inch in front and 1 foot behind, with pieces soldered in at the ends (or made of wood), and hooks placed in front at the ends for the attachment of ropes. If to run on rough ground, it will be better to put runners 1½ or 2 inches high underneath. Into this put a layer of coal-tar half an inch deep, or water and kerosene. It can be drawn by a boy at each end, or by horse-power if preferred.

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"To treat pastures and meadows for grasshoppers and leaf-hoppers, it would seem from present experience the best plan to run over all grass lands early in May with the simple dozer described for leaf-hoppers (a piece of sheet iron 8½ feet long and 2 feet wide was coated on the upper side with coal-tar, and lying flat on the sod was dragged along by means of three cords, one fastened at each end and one in the middle). Pastures should be treated a second time, about the middle of June. For meadows, the second treatment may follow hay-cutting, if insects are abundant, and then, if grasshoppers appear in July in numbers, resort to the deep hopper-dozers described above."

"Summarising the results of his experiments with leaf-hoppers, the same writer says: 'Experiments with hopper-dozers for grass leaf-hoppers show that this method can be used very successfully in capturing the insects; that the simplest form, a flat sheet of iron, was most satisfactory; that one application resulted in adding 34 per cent. to the crop of hay on a plot experimented on, and in one experiment leaf-hoppers were captured at the rate of 376,000 per acre.'

"These results are most striking, and one cannot but feel convinced that it would pay well to adopt systematically such a simple and cheap method of freeing pastures of the myriad insects which reduce the yield every year."

"The use of hopper-dozers in the Western States for the destruction of locusts is recognised as one of the standard methods of fighting these injurious insects, and has been attended with marked success. The other method which is relied on is ploughing the land where the eggs have been deposited, so as either to bury them deeply, so that the young cannot emerge in spring, or so as to expose them under unnatural conditions to the frosts of winter or their numerous predacious enemies. In the thickly settled portions of Canada where, as a rule, stubble fields are regularly ploughed up before winter, we, as a consequence do not suffer from locust plagues so frequently as is the case in the West."

"The use of insecticides such as Paris green for locust attacks is seldom a practical remedy, except on limited areas. In response to some who have applied for the receipt of the bran and arsenic remedy, I extract the following from Professor Clarence Weed's useful little work 'Insects and Insecticides':—

A mixture which has been successfully employed consists of arsenic, sugar, bran and water, the proportions being one part (by weight) of arsenic, one of sugar, and fifty of bran, to which is added a certain quantity of water. The arsenic and bran are first mixed together, then the sugar is dissolved in water and added to the bran and arsenic; after which a sufficient quantity of water is added to thoroughly wet the mixture. About a teaspoonful of this mixture is thrown on the ground at the base of each tree or vine (in gardens and orchards) and left to do its work."

"I found by experiment that the poison works slowly, but is very effectual."

Cicadas are reported from Armstrong, Enderby and Okanagan Valley.

No injury is done by these insects in feeding, but their egg-laying habit causes considerable trouble. The eggs are laid in the twigs and branches of trees, a series of slits being cut

by the ovipositor of the female, forming chambers in which the eggs are arranged in series. No practical remedy for this pest has been found, but as birds are fond of the insects, they should be encouraged in the orchard as much as possible.

This well known enemy of greenhouse plants (*Tetranychus telarius*) is also injurious to fruit-trees and plants in the open, especially in some portions of the Interior. In greenhouses it is best dealt with by keeping the air saturated with moisture. Infested trees or plants in the open should be sprayed with the No. 1 wash in the dormant season, or in summer with the tobacco and soap (No. 6) or quassia and soap washes (No. 2) where the pest is known to be present.

The Red Clover-mite (*Bryobia pratensis*) is more widely distributed in old orchards in the lower part of the Province than is generally known, a close examination of the trees generally disclosing the eggs during the winter months. The amount of injury done by the insects has not been determined, nor have any complaints been made as to its presence on clover plants. I find that two spraying with the No. 1 wash (lime, salt and sulphur), following the directions given, will destroy the eggs. It is a near relative of the common red spider so troublesome in greenhouses, and feeds upon plant tissues in the same manner.

This enemy of the pear tree (*Phytoptus pyri*) is found all over the Province, and is very injurious. It appears on the leaves of pear trees in spring, causing small reddish spots on their upper surface. As the season advances these spots become darker, finally almost black, the tissues of the leaves being dry and dead. The pest itself is a very minute, eight-legged mite. The exceedingly minute oval grayish eggs are laid by the females in spring within the galls they have formed, and here the young are hatched. Sooner or later (just how long they remain has not been ascertained) they escape through the opening in the gall and seek the healthy part of a leaf, or more often crawl to the new growth and start fresh galls. In autumn they leave the galls and migrate to the winter buds at or near the ends of the twigs. Here they work their way beneath the outer scales of the buds and remain during the winter. In this position they are ready for business in the spring as soon as growth begins.

The No. 1 spray (lime, salt and sulphur) is found to exterminate this pest here; it is advisable to make two applications, and be sure that the spraying is thoroughly done, and the mixture warm when applied, late in the fall or early in spring.

The Cabbage Maggot (*Anthomyia brassicae*) is reported from Salmon Arm and Surrey Centre.

The adult is a small, two-winged fly, somewhat like the common house-fly in general appearance, which appears in the cabbage field soon after the plants are set out, and deposits its eggs about the stems at the soil surface. The little whitish maggots soon hatch, and work their way downward to the roots, which they attack, feeding upon the outer surface and thus making grooves, or boring into the interior and hollowing out cavities. They sometimes cause the roots to thicken up and become malformed, producing an effect similar to that of the fungus, causing the disease known as "club-root." In two or three weeks the maggots become full fed, and they change to the pupa state within hard brown puparia, to emerge some days after as adult flies. There are probably three or four broods each season, and the insect apparently hibernates in each of its three latter stages. These insects infest turnips and rutabaga, as well as cabbage, and some entomologists consider the radish maggot as being also of this species.

Satisfactory remedies for this insect are few and far between. European writers recommend that coal dust be scattered around most of the plants, leaving one occasionally without the dressing to attract the flies to it for egg-deposition, and then destroying

Remedies. the unprotected plants, together with the insects about their roots. Dr. Riley has suggested that ashes or slacked lime will probably answer the purpose as well as the coal dust. As some of the larvæ or pupa appear to pass the winter upon the old roots, it is advisable to pull up and burn such plants in autumn. Probably the most practicable remedy is that of always putting new plantations of cabbages some distance from where they were grown the previous year. This has been found in practice to give good results. The flies are sluggish, and apparently do not scatter far from where they reach maturity. The maggots may be destroyed by pouring a small quantity of kerosene emulsion about the infested roots. In some localities the growers search regularly about the bases of the stems for the bunches of whitish eggs, and claim it to be the best method of checking the injuries of the pest.

The Onion Maggot (*Anthomyia ceparum* or *Phorbia ceparum*) is reported from Salmon Arm and Victoria.

The onion maggot is closely related to the cabbage maggot, to which it is similar in life-history and habits. The adult is a two-winged fly, which deposits its small white eggs on the bulbs or lower leaves of the young plants. About a week later the eggs hatch into young larvae that bore into the bulbs, absorbing the succulent substance. When one bulb is consumed they pass on to another. The full-grown larvae are nearly half an inch long, of a dull white colour, and pointed at the mouth or front end. They complete their larval growth in about two weeks, and then leave the onions and enter the surrounding earth, where they change to the pupa state within brown puparia. A fortnight later the flies emerge to lay eggs for another brood.

Professor Cook states that the most practical method of preventing the injuries of this insect is to change the position of the onion bed every year, putting it each time some distance from where it was the preceding season. Wherever the conditions are such that this can be done, this is probably the best preventative measure. Miss Ormerod reports that if the bulbs are kept covered with earth they are not attacked by the maggots.

Onion Maggot.

Remedies.

Bot Flies.

Bot flies (*Estrus equi*) are reported from Quamichan, Sooke, Metchosin, Okanagan and Mission, no doubt present in many other localities.

"The larvae of the *Estrus equi*, a species of gad-fly, are often found in large numbers, attached by a pair of hooks with which they are provided, to the cardiac extremity of the stomach; they are rarely met with in the true digestive portion of this organ, but sometimes in the duodenum or jejunum in small numbers. * * Sometimes nearly all the cardiac extremity of the stomach is occupied with them, the interstices being occupied by little projections which are caused by those that have let go their hold, and have been expelled with the food. It often happens that a meddling groom, when he sees them expelled from or hanging to the verge of the anus, as they often do for a short time, thinks it necessary to use strong medicine, whereas, in the first place he does no good, for none is known which will kill the larva without danger to the horse, and, in the second, if he will only have a little patience, every bot will come away in the natural course of things, and until the horse is turned out to grass, during the season when the *Estrus* deposits its eggs, he will never have another in his stomach.

"The *Estrus equi* comes out from the pupa state in the middle and latter part of summer, varying according to the season, and the female soon finds the proper nidus for her eggs in the hair of the nearest horse turned out to grass. She manages to glue them to the sides of the hair so firmly that no ordinary friction will get rid of them, and her instinct teaches her to select those parts within reach of a horse's tongue, such as the hair of the forelegs and sides. Here they remain until the heat of the sun hatches them, when, being no larger in diameter than a small pin, each larva is licked off and carried down the gullet to the stomach, to the thick epithelium, to which it soon attaches itself by its hooks. Here it remains until the next spring, having attained full size during the course of the first two months of its life, and then it fulfils its allotted career by letting go and being carried out in the dung. On reaching the open air, it soon assumes the chrysalis condition, and in three or four weeks bursts its covering to become the perfect insect.

"From this history it will be evident that no preventative measures will keep off the attacks of the fly when the horse is at grass, and, indeed, in those districts where they abound, they will deposit their ova in the hair of the stabled horse if he is allowed to stand still for a few minutes. The eggs are, however, easily recognised in any horse but a chestnut, to which colour they closely assimilate, and as they are never deposited in large numbers on the stabled horse, they may readily be removed by the groom. Unlike other parasites, they seem to do little or no harm, on account of the insensible nature of the part of the stomach to which they are attached, and moreover, their presence is seldom discovered until the season of their migration, when interference is uncalled for. On all accounts, therefore, it is unnecessary to enter into the question whether it is possible to expel them; and even if by chance one comes away prematurely, it will be wise to avoid interfering by attempting to cause the expulsion of those left behind."

How Propagated.

Preventions Discussed.

Mosquitoes are reported from Kelowna, Spallumcheen, Bridge Creek, Chilcotin, Fort Steele, Port Kells, Mount Lehman, Upper Sumas, Sumas, Hope, Squamish, Dewdney, and Agassiz. Owing to high water in the Fraser River during the past season, and the consequent overflowing of large areas of low-lying land, these pests have been more troublesome than usual. Stagnant water furnishes breeding places for them, and when it is present on such a large scale, there is no practical means of relief from the insects.

Where the opportunities for breeding are few, they can be checked to a considerable extent by keeping cisterns and rain-barrels well covered, and by pouring on the surface of ponds or marshy places a small quantity of cheap kerosene. The oil spreads in a thin layer over the surface, and kills all larvae and pupae present. The female mosquitoes are also killed while attempting to oviposit. Unfortunately, this method is only applicable to small areas. Where exposure to mosquito attacks is unavoidable, Dr. Smith writes that the following mixture will serve to keep off the pests:

Oil of Pennyroyal.....	1 part.
Oil of Tar.....	2 parts.
Olive or Cottonseed Oil	2 "

Mixed together.

Rub all exposed parts with this mixture, which will secure exemption for from one to two hours, or longer, without renewal, depending upon the temperature and the amount of perspiration.

This may perhaps prove useful to some persons who may only be exposed to attacks for a short time and who would suffer severely if not protected in some way.

BENEFICIAL INSECTS.

It is now generally known that in addition to what are called "injurious insects," those which cause damage or loss to the fruit-grower and farmer, there are also a great number of "beneficial insects," which feed upon or are parasites of the "injurious insects."

In this connection Dr. J. B. Smith writes:—"In the course of the ages through which this world has existed there has been gradually established, by the influence of surroundings, a certain ratio between all existing life, vegetable and animal. There is a struggle among plants themselves as to which shall keep the ground, and upon the plants feed animals, including insects, which form a factor in determining the relative abundance of the different species. With the development of plants their enemies also have developed. One of nature's ways of preventing the plant-feeding insects from obtaining control of and exterminating the plants is to provide enemies of various kinds for them. These enemies in turn must be checked, that they may not exterminate the species they themselves feed upon. Thus there has been established, gradually and naturally, an elaborate system of checks and counter-checks, by means of which a certain proportion is maintained between predaceous, parasitic, and plant-feeding insects. Under natural conditions this ratio does not change much from year to year. Any interference with this established course is almost certain to be disadvantageous in some direction, and man, in his dealings with natural conditions, has persistently created for himself a series of troubles arising from his own acts. By planting large areas of one crop, he has favoured the increase of insects feeding upon that crop. Man has further disturbed the natural conditions by introducing into new countries insects that have become adapted to the surroundings in others. Sometimes an insect so introduced does not find the new circumstances to its liking; but on the other hand, it may find them very much better than those under which it was originally developed. In such cases we get a multiplication out of all proportion to the normal habit of the species, and there may be destruction of the plants that they feed upon. A fascinating theory in connection with this subject is the possibility of importing parasites or predaceous forms of insects from other countries for the destruction of pests here.

The process of evolution.

The case of the Australian *Vedalia cardinalis*, imported to prey upon the fluted scale *Icerya purchasi*, is frequently cited as an example of what can be done. When this insect enemy was introduced, it found nothing that it recognized except the *Icerya purchasi*, and in consequence devoted itself entirely to that species, totally suppressing it in a short time. All that was done here was to restore the "balance of nature." Nothing can be argued from this case as to the possibility of introducing foreign species to control strictly American pests with which they are not acquainted.

We can, however, frequently do good where we have imported insects, or insects occurring also in other countries, by finding and introducing their parasites or enemies.

In the Report of the California State Board of Horticulture for 1895-6, Mr. Alex. Crow, Chief Quarantine Officer, says, referring to the work of beneficial insects in that State:—"I

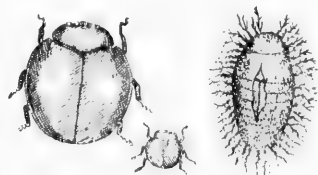
Extent of
benefit.

would go more fully into this subject to sustain your advocacy of this method of combating destructive scale insects, but time is rapidly proving that your policy has been wise and correct. We do not look for, nor have you ever stated that we can secure, complete extermination of our orchard pests by parasites; but who in California now fears the heretofore destructive 'cottony cushion scale,' the 'pernicious scale,' the 'yellow scale,' the 'cottony grape scale,' the 'soft orange scale,' the mealy bugs, and we can soon add all the *Iccanions* to the list."

All the foregoing have been destructive in their time, and have been regarded with dread by orchardists. Of course, with the disappearance of their food, the parasites naturally disappear and the scale may show up again, but colonies of beneficial insects can again be liberated and clean them out. Similar good results are also reported from the Sandwich Islands.

In Oregon, Dr. Cardwell reports that the "woolly aphid" and "green aphid" are disappearing in many localities before the rapidly increasing army of lady-bugs. Mr. H. E. Doseh reports the presence of large numbers of predaceous beetles, *Podabrus comes*, feeding upon green and woolly aphides. They are ravenous feeders, and rapidly cleared orchards of these pests.

In British Columbia the number of predaceous insects is certainly increasing very fast, the work of syrphus fly larva and ladybirds of different kinds feeding upon aphides being especially noticed. The convergent ladybird, *Hippodamia convergens*, I found in the vicinity of Victoria in October, going into winter quarters in thousands. During the coming season efforts will be made to introduce species from California and Oregon likely to prove serviceable here.



Beetle.

Larva.

TWICE-STAMPED LADYBIRD (*Chilocorus biplagiatus*).

This is a beautiful little black beetle with two bright red spots on its wing-covers. The larva is shown in the cut, and is black, crossed by a bright yellow band about the middle, and is armed with many soft, long, branching spines. This Ladybird preys upon various scales, and is especially destructive to the San Jose Scale (*Aspidiotus perniciosus*).

Twice-Stamped
Ladybird

This very small beetle feeds upon scale insects and delights in attacking the red spider. To the naked eye it appears deep black and shiny, and at the touch drops or rolls off, but before reaching the ground spreads out its wings and flies away. The colour of the body is yellowish grey, and is thickly covered with mealy powder. The head is black

**Brown-Neck
Ladybird.**

and the neck brown. The wing cases are black and covered with hair.



**BROWN-NECK
LADYBIRD.**
(*Seinus
marginicollis*.)



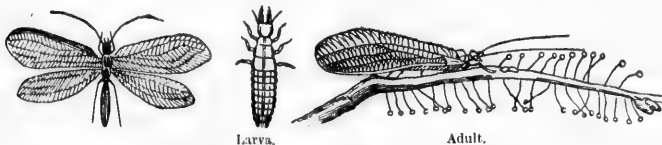
AMBIGUOUS LADYBIRD (*Hippodamia ambigua*).

This is a blood-red Ladybird, which is very plentiful. The larva is one of the largest of the Ladybirds, and feeds upon aphides. It also attacks woolly aphis. Its larva feeds largely upon this aphis.



CONVERGENT LADYBIRD (*Hippodamia convergens*).

This beetle works destruction to aphids and scale insects, and is quite common.



LACE-WINGED FLY (*Chrysopa*). Sp. unnamed.

While the Ladybirds are great destroyers of scale and aphids, the larvae of the Lace-winged Flies rid trees and plants of millions of *Aphids*. The fly has a slender body, with delicate, gauze-like wings, and its colour is generally green, with golden eyes. The eggs are deposited on pedicles and laid in the midst of a group of aphides. The larva is supplied with sharp mandibles, with which it attacks the aphids.

**Lace-Winged
Fly.**

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K BROWN-NECK
LADYBIRD.
(*Seinura
marginicollis*.)



Fig. 1.



Natural size.

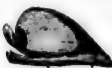


Fig. 2.



Natural size.



Fig. 3.

SYRPHUS FLIES. Sp. unnamed.

In the above cuts Fig. 1 represents the fly; Fig. 2, magnified, the case in which it transforms into a fly, and Fig. 3, magnified, the larva.

The Syrphus Flies are also great destroyers of aphides. The larvæ feed entirely upon aphides, and appear and disappear as the aphides appear and disappear. The larva is a footless, eyeless, flattened, transversely wrinkled, gaily coloured, green and purple

Syrphus Flies. maggot, having a very extensile body, which enables it to reach up and grasp the aphid with its peculiar looking mouth. The single egg, deposited in a group of aphides, hatches forty-eight hours after it is laid, and the larva becomes full-grown and transformed into a pupa in five or six days. The reason of this extremely rapid development in the first two stages, the egg and the larva, is explained when we consider how brief is the existence of the aphid, and how suddenly its colonies appear and disappear. When the larva is actively feeding it destroys dozens of aphides, one after the other, and its body changes colour. When filled to repletion the larva falls into a lethargy, lasting two or three hours, during which the process of digestion changes the juices of the body to varying shades of brown. After the process of digestion has taken place, the larva again begins its work devouring aphides.



DEVIL'S HORSE or WHEEL BUG (*Prionidus cristatus*. Linn.)

This insect feeds upon scales and aphides and destroys large numbers of caterpillars. The female deposits her eggs in a hexagonal mass on the leaves and bark of trees, on fence rails, etc. Generally, there are about seventy eggs in a bunch. The young are

Wheel Bug. blood-red in colour, with black marks, and resemble the adult only in form and habits. These insects prey upon pests by inserting into them their proboscis, which injects a most powerful, poisonous liquid into the wound. The victim thus pierced

dies in a very short time. They then leisurely suck the juice out. The perfect insect is of a gray colour and has a high, semicircular ridge or projection on the crest of its throat.

the Lace-winged
with delicate,
ten eyes. The
oup of aphides.
ucks the aphids.

FUNGIOUS DISEASES OF TREES, PLANTS, AND FRUITS.

The following excerpt, *re* these, is taken from Bulletin No. 23 of the Central Experimental Farm:

"A brief consideration of the principles underlying the practice of spraying may enable the grower to understand the nature of fungous diseases, and this will be of service in directing an intelligent application of the remedies which are recommended. A glance at the character and habits of parasitic fungi will throw light upon the system of treatment.

The word *fungi* is used to designate an exceedingly numerous class of plants of simple organization; we must never lose sight of the fact that they belong to the vegetable world, and are therefore subject to the ordinary conditions of plant life. Some of them derive their nourishment from living plants and animals, others from dead plants or animals. Those which draw their food from other plants more highly organized than themselves are termed parasites, and it is with this class that the fruit-grower is chiefly concerned. These plants (parasitic fungi) have not the power of assimilating food from the soil or atmosphere, and therefore must obtain it in a prepared condition through the agency of the higher plants upon which they feed. The vegetative part of a fungus—that part corresponding to the root, stem and leaves of the higher plants—is made up of delicate thread-like tubes, usually more or less matted together; these collectively are termed *mycelium*. The term *hypha* is applied to a single thread-like tube. Parasitic fungi bear no seeds or flowers, but are reproduced by spores, which are borne upon specialized branches of the hyphae. These spores are produced in great numbers and are the principal, though not the only, means of spreading disease. The hyphae-threads of the parasitic fungi penetrate the tissues of the host plant—a name applied to the plant upon which they feed.

The spores are exceedingly light and easily carried by currents of air. When one falls upon a leaf and is supplied with moisture it germinates by sending out a slender tube, which effects an entrance into the tissues of the leaf through the breathing pores (stomata) or intercellular spaces. After the parasitic fungus has thus entered the interior of a leaf, it develops rapidly at the expense of the tissues of the latter. Pushing forward from one cell to another, the contents are appropriated and fresh vigor is thus gained by the parasite. This goes on till the vigor of the host plant is much impaired, or its life destroyed. Some of the principal parasitic diseases attack both foliage and the fruit of the host plant, as in the case of the "mildew" of the grape, "scab" of the apple and pear, and "rot" of the plum and peach. They are thus doubly destructive. If this destruction were confined to a few cells, leaves, or even to a few plants, the loss would be trifling; but the extraordinary rapidity with which fungi multiply, and the ease with which their reproductive bodies (spores) are carried from plant to plant, renders their extirpation a very difficult matter.

This explanation of the methods of reproduction and growth of these diseases emphasizes the truth of the maxim that "prevention is better than cure." When the mycelium of the fungus has become established within the tissues of the host plant, any remedy applied to the exterior of the plant, it is readily seen, can at the best be only partially effective.

Fungous diseases, in accordance with natural laws, will in all probability increase in number, in proportion as the food plants upon which they prey are multiplied, and as climatic conditions are favourable to their development."

There are many ways in which the injuries of fungous diseases may be prevented. Among these are the following:—

- (1.) As a general rule, not however without important exceptions, plants weakened in vitality are more subject to the attack of parasitic fungi than those in vigorous growth. Consequently, methods of cultivation and fertilisation, which tend to produce sound development and early maturity, should be adopted as far as practicable.

Fertilisation and
Cultivation.

(2.) It has long been observed, that with many crops certain varieties are more liable to fungous diseases than others. The reason for this, in many cases, is not well understood, but the fact will lead the careful cultivator to select such varieties as prove most resistant in his locality. Injurious fungi may be largely destroyed by keeping farm and orchard premises clean and free from weeds and rubbish. Burning potato tops, old tomato vines, and similar refuse, will destroy millions of spores of fungi attacking those plants. The same may be said of apples and pears infected with scab of the fruit, which are too often left hanging on the trees or lying on the ground, to propagate their spores the following season.

Selection of Resistant Varieties.

(3.) With diseases like the brown-rot of plums and cherries, much may be done in reducing injury by persistent hand picking of infected fruit, which should be burned.

Hand Picking.

(4.) The most practicable way of preventing the majority of the fungous diseases of plants, is by the use of "fungicides" or fungus killing mixtures. These act either by directly destroying any fungus spores present at the time of application, or by remaining on the surface, in a condition to destroy, either before germination or during that process, any spores that may alight upon the plant treated.

Use of Fungicides.

As treatment is preventive, great care must be exercised to have the work done at the proper season, and to be sure that all parts of trees or plants sprayed are wetted with the fungicide used. Drenching is not necessary, and sometimes results in injury to the foliage or fruit. The aim should be to deposit a thin film or coating of the spray upon the entire surface treated. To accomplish this, the Vermorel nozzle should be used to distribute the spray used.



APPLE SCAB or BLACK SPOT OF THE FRUIT (*Fusicladium dendriticum*).

Reported from all parts of the Lower Province, causing great loss to fruit-growers by rendering the fruit useless or unsaleable.

There is probably no fungous disease of fruit so familiar as the apple scab or black spot of the fruit. The fungus which produces the well-known black spots or scabs on the fruit also attacks the leaves and young shoots. It first appears on the leaves in the shape of smoky, greenish spots, more or less circular in outline. These gradually enlarge and run together, so as to form good sized blotches; as they grow older the colour darkens, finally becoming almost black. The young fruit is attacked almost as soon as formed, and sometimes shrivels up and drops off.

Apple scab.

The spores or reproductive bodies of the fungus are produced in immense numbers on the blackened spots on the leaf and fruit, forming most abundantly during cool, wet weather. They are disseminated by the wind, etc., and when they light upon a moist leaf or fruit they germinate, sending out a little tube or root, and thus form a new centre of disease. The spores pass the winter on the bark, twigs, and stored fruit, as well as on the fallen leaves and fruit. The mycelium or vegetative portion of the scab fungus develops just beneath the skin of the leaf or fruit, but as a rule does not penetrate deeply into the tissues. After a while it pushes outwards, rupturing the skin and developing fresh spores.

In spring, just before the leaf buds open, spray thoroughly with the diluted Bordeaux mixture, or before the buds swell with the simple solution of sulphate of copper. Repeat the application of Bordeaux just before the blossoms open, and again just after the blossoms fall (these two applications are most important); if necessary, repeat again in ten days' time, but do not use the Bordeaux mixture late in the season, or it may roughen the skin of the fruit. If late spraying is required, use the carbonate of copper mixture. (See "Spraying Mixtures.")

Pear scab (*Pusicladium pyrinum*) is also generally reported from all coast districts. This disease is very similar to apple scab, believed by many botanists to be the same species.

Pear scab. At any rate, the chief points in its life history and remedial treatment are the same as for the "apple scab."

Pear-leaf blight (*Entomosporium maculatum*) is reported generally from districts in the Lower Province, and from Kelowna and Salmon Arm in the Interior. This is probably the most generally destructive fungus disease to which the pear is subjected. It appears early in the spring, soon after the leaves develop, first as minute, dull reddish spots on the upper surface of the leaf. A little later the spots appear on the lower surface of the leaf, which becomes darker in colour; as the fungus develops the spots enlarge, until nearly the entire leaf is affected and becomes sere and brown. Very young leaves sometimes curl up when attacked; the stems and fruit are also attacked, the pears cracking open and becoming worthless.

The effect upon the tree is very injurious; it is unable to store up the materials of growth properly, and becomes weak and impoverished. Hundreds of pear trees in the Coast districts, which used to produce fine fruit, of late years have been valueless from the effects of this disease.

Where Bordeaux mixture has been used according to the directions given, infested trees have recovered, and are again producing healthy foliage and clear fruit. But it must be remembered that many trees are so badly injured by this and other fungus diseases that two seasons are required before trees will become productive again, owing to the loss of fruit spurs and buds, which have to be reproduced.

Remedies. Bordeaux mixture, used as for apple and pear scab, is the best preventive, and the carbonate of copper solution, No. 10, for late spraying on trees bearing fruit.

Dead Spot is reported from all districts of the Lower Provinces, as prevailing to a greater or less extent, in many instances killing young trees. There is still great diversity of opinion in regard to this disease or condition of the apple tree. Prof. L. B. Pierce, who was specially detailed by the United States Department of Agriculture for the purpose, has been making a careful, systematic investigation regarding the disease as it occurs in Oregon and Washington, and although the investigations are not complete, it is stated that "dead spot" is the result of a parasitic fungus, which is probably transmitted from tree to tree, by means of spores blown by the wind, or carried by insects, &c. Mr. M. O. Lowndale, of Lafayette, Ore., who has also studied the disease, writes me in regard to it as follows:—

"Dead Spot is caused by a deep-seated fungus that finds its sustenance in the inner tissues of the bark and only appears on the surface for the purpose of spore formation and reproduction. The mycelium of the fungus spreads in various directions through the bark and can generally be cut out without any injury to the tree, stripping off all the dead outer bark and diseased tissue. After the fungus has attained its growth, it produces its spores in small excrescences on the surface of the dead spots.

Its Cause. These little pustules burst, when the spores escape, and are carried by the air and insects to other trees and other portions of the same tree. They germinate in autumn, and begin to penetrate the bark at once and repeat their cycle of growth. The spore-bearing vessels burst during July and August, and as no spray can reach the fungus after germination, a midsummer spraying, when the trees are badly infected, is desirable."

We have produced cultures of the canker or "dead spot" fungus and have inoculated healthy trees, which have produced typical "spots" at the point of inoculation; these spots have increased in size and run their cycle of growth, and in turn again produced their spores.

As an ordinary preventative, autumn spraying would probably be sufficient, but in severe cases both should be used. All dead spots should be cut out and burned, for they hold myriads of spores that only await a favourable opportunity to produce new infections. The midsummer spray to use on bearing trees would be five ounces copper carbonate and three pints ammonia in 45 gallons water.

On young trees, or trees not in fruit, six pounds sulphate copper, six pounds lime, 50 gallons water. The autumn spray should be six pounds sulphate copper, ten pounds lime, 50 gallons water." It will be noted that these sprays are about one-half stronger than the ordinary Bordeaux mixture, as advised for use in British Columbia.

In British Columbia I have observed that dead spot does not occur in the interior valleys, and either not at all or to a very slight extent in orchards of the lower Province situated on soils containing plenty of lime, such as clam-shell beaches, where there is good under drainage. It is now pretty well established that many soils on which orchards are planted contain a very small per centage of lime, and again the question of proper drainage of orchard land has not received the attention required. I have frequently noticed that fruit-trees are standing in soil where the water table during the winter months is almost or quite level with the surface. Now, whatever direct treatment is made to trees affected with "dead spot," it is most important that these matters should receive attention—healthy trees cannot be expected, unless they are surrounded with what may be termed proper "sanitary conditions," and supplied with the elements of plant food necessary to promote healthy growth. Where wood ashes are available in sufficient quantity, they should be used freely in the orchard, and if not obtainable, lime and muriate of potash in their place, and, if convenient, well worked in with the harrow or cultivator in early spring, as far as the roots of the trees extend.

In planting new orchards, care should be taken not to plant the trees too deeply. I draw attention to this as I find it is rather a common error, and one very difficult to remedy later on.

On soils inclined to be wet, it is better to plant on or near the surface and mound up the soil over the roots of the trees.

For young trees, stable manure should be applied very cautiously, as it stimulates wood growth to an undue extent. On some rich soils it has been observed that frequent cultivation has had the same effect.

In regard to these matters orchardists should study their soil and local conditions, the aim being to produce a fair amount of new wood on trees every year, which will harden and ripen up properly in the fall, and avoid the production of overgrown sappy shoots, which apparently indicate a condition of the trees highly favourable to the development of "dead spot."

Give your fruit-trees as nearly as possible "ideal conditions," by planting on soil suitable for the purpose, and supplying proper care, cultivation and plant food; then, if disease appears, treat them with remedial applications designated to destroy the intruding disease or parasitic growth.

This name has been applied to the gumming of stone fruit trees, especially of the cherry, which prevails to a greater or less extent all over the Province, and has caused the loss of large numbers of young trees. A great difference of opinion exists among

Gummosis. practical fruit-growers as to the disease itself or its exciting causes. Injudicious pruning is no doubt the cause of gumming of the cherry tree in some cases, and Downing's rule in this respect should be followed—that is: "Prune as little as possible, and only to remove a dead or crossing limb, and this should be done in midsummer." Over cultivation is another exciting cause, and frequently results in the production of too luxuriant a growth, but perhaps the chief reason of the "gumming" in the lower parts of the Province is the unsuitableness of location, the land being too wet in winter and too dry in summer and early fall.

Many trees have been set, which were fore-doomed to fail, being already infected, and intending planters cannot be too careful in the selection of healthy stock, and of land naturally fitted for cherry growing.

In Oregon, the disease exists largely, and it is there concluded—"That the causes of gummosis are not always the same, or apparently not. It is probably a disease of the physiological nature, and affects nearly if not all of the stone fruits. It may appear in either of two forms, local or constitutional. Locally in the form of gum pockets on trunk or branch in isolated situations. The constitutional form may also show gum-pockets, but these will be found upon examination of cross-sections of the wood to be connected with each other by a series of gum-filled cells in the wood, which may be seen with the eye as dark brown lines or cells. Either local or constitutional gummosis is most likely to affect trees which have been quite dry at one time and wet at another.

"Mr. Newton B. Pierce suggests the following:—Cut out as much of the diseased Treatment bark as possible, and spray the trees with Bordeaux mixture."—*Report of Recommended. the Oregon State Board of Horticulture.*

I have received very favourable reports concerning the treatment of gummosis, by a free use of wood ashes applied to the soil on which the trees stand, especially when combined with mulching to retain moisture, and although this may appear a very indirect way of treating the disease, it is one I strongly recommend. If wood ashes are not available, air-slacked lime and muriate of potash can be used instead, in the same way.

Powdery mildew (*Podosphera oxyacantha*) is reported from Victoria, Saanich, New Westminster, Ladner's Landing and Vernon.

Powdery mildew appears usually about mid-summer, as small round whitish blotches, which soon enlarge and run together on the leaves and young shoots of most varieties of fruit-trees. It spreads by means of spores, immense numbers of which are produced and disseminated; wherever there is light and sufficient moisture present, they germinate and start the disease anew. It is usually more abundant on young trees than old ones, and is especially destructive to nursery stock.

The powdery appearance is caused by the presence of large numbers of minute white spores, known as conidia or summer spores. The disease is carried over winter on the leaves, etc., in spores contained in small black cases, called *perithecia*, which are just visible to the naked eye. The mycelium or vegetative portion of the fungus is external.

Spray with diluted Bordeaux mixture or the carbonate of copper solution, making the first application when the leaves are about half grown, and repeat three or four times at intervals of ten days.

Treatment.

This well known disease (*Sphaerotheca mors-uvæ*) of gooseberries of English varieties, is common all through the lower Province, and the past season has been very injurious in the Okanagan District. It is noted that in Nanaimo there is little injury from this disease, and as a consequence the choice varieties of gooseberries are largely grown there. The reason of this comparative exemption has not been satisfactorily explained. This fungus usually appears in spring upon the leaves and buds, first showing as a sparse, cobwebby covering, which later appears white and powdery, from the production of summer spores. The young berries are also attacked, sometimes being dwarfed or misshaped. As the summer progresses, infested leaves and fruit become browned, and covered with a thick growth of the fungus mycelium. The summer spores are very light, and blow about with the wind; when one falls upon a damp gooseberry leaf or fruit, it germinates by sending out a slender tube, from which the mildew spreads. As these summer spores are unable to survive the winter, the fungus produces what are called winter spores, consisting of small round cases, from which project about a dozen short, delicate appendages. These are the outer spore cases, and contain flattened oval bodies called the inner spore cases, within which are spores which germinate in the spring. Gooseberry mildew is often very difficult to control, chiefly because preventive measures are begun too late.

Spraying with Bordeaux mixture should commence very early, just as soon as the leaf buds burst, and be repeated at intervals of a week or ten days for three or four applications; if

Remedies.

further treatment is required after the fruit is well formed, use a spray made with sulphide of potassium (liver of sulphur), at the rate of $\frac{1}{2}$ oz. to 1 gallon of water. A winter spraying of gooseberry bushes before growth starts, with

the No. 1 spray, has apparently given good results, by destroying the winter spores, and is recommended. It will be found that after the mildew is once subdued, less spraying will be required in following seasons.

Black Knot on cherry and plum trees (*Ploerightia morbosa*) is reported from Keremeos, Kelowna and Victoria.

Black knot occurs on the native choke-cherry in the Upper Country, but so far has not attacked cultivated trees to any appreciable extent; however, any cases that occur on orchard trees should be summarily dealt with, and infected wild trees destroyed. The

Black knot. experience of Ontario and the Eastern States, where thousands of plum and cherry trees have been destroyed on account of this disease, should warn us to be prompt and thorough in dealing with it here.

The only successful treatment for a badly infected tree is to take it out and burn it. All knots on trees but slightly infected should be cut out and burned. Do not throw removed knots on the ground, as spores are developed off as well as on the tree. Spots from which knots have been cut should be painted with turpentine or oxide of iron paint, and this method followed up until the disease is thoroughly extirpated.

Brown Rot of plums and cherries (*Monilia fructigena*) is reported from New Westminster, Lulu Island, and Burnaby.

This destructive disease of stone fruits is evidently becoming more troublesome. The annual cycle of the fungus of brown rot is outlined as follows, starting with its attack upon the fruit:—A minute spore falls upon the plum on which there is moisture, and sends out a germinating tube which penetrates the skin of the fruit.

Brown rot.

Once inside, it grows rapidly, pushing its mycelium through the pulp in all directions, absorbing the contents of the cells, and causing the so-called rot. Infected plums at first turn brown in spots, these enlarge gradually until the whole plum becomes brown and rotten. When it has reached this stage, it becomes covered with a brownish or ash-coloured velvety coating, which consists of vast numbers of minute spores. These spores are blown about by wind and spread the disease to other fruit, if the conditions are favourable.

The rotten plums continue hanging upon the trees, gradually shrivelling up until they become dry and mummied husks, and many of them remain on the trees through winter. On these mummied plums some spores will adhere until the following season, and in nearly all of them, the mycelium remains in a dormant condition, so that during the warm damp weather of spring this mycelium is able to produce a new crop of spores, which develop on the blossoms, young leaves, and fruit.

The first essential to success in preventing this disease is to gather up and pick off and burn all mummied plums. Then the lime, salt and sulphur wash should be applied while the

Treatment. trees are dormant, to the ground under the trees as well as the trees themselves. Then spray the trees with Bordeaux mixture before the blossoms open; repeat this after the fruit is formed and again after an interval of ten days, where the disease has been troublesome. If later spraying is needed, use the carbonate of copper spray, No. 10.

In packing fruit for market, growers should be especially careful to exclude any plums or cherries in the slightest degree infected with this disease, as it spreads very fast in the packages and there is a great risk of spoiling all the contents.

This fungus disease (*Cylindrosporium padi*) is common on the lower Mainland and parts of Vancouver Island.

Small discoloured spots on the leaves of plum and cherry trees are first seen, usually of a purplish colour; in a short time these spots turn brown, the tissues being destroyed, and later

Shot hole Fungus.

the leaves become yellow, many of the affected areas separate from the surrounding portion of the leaf and fall to the ground leaving holes in the leaves, hence the name "Shot-hole fungus." This disease may be prevented by the use of Bordeaux mixture, as advised for "brown rot."

Peach Leaf-curl (*Taphrina deformans*) is reported from Agassiz, Victoria, Hatzic, New Westminster, and found more or less all through the lower Mainland.

This disease is much more injurious some seasons than others, owing to differences in climatic conditions. It causes the leaves to become curled and misshapen, and later to fall off. When it is very severe, the fruit falls prematurely. Defoliated trees will usually put out new foliage, but too late to save the crop.

The No. 1 spraying mixture has been found to give good results, applied in early spring, before the buds swell. It is recommended to cut off and burn affected parts as soon as noticed.

Treatment.

The disease known as *Erysiphe rubi* continues to be very destructive in Victoria and vicinity to raspberry canes, and in conjunction with root-borers has caused the loss of many "patches" of canes. A fungous disease of the fruit, causing it to turn hard when partly grown, is also reported from Duncan's. In both cases the best treatment for the fungous diseases is a free use of the Bordeaux mixture. Old canes should be cut out and burnt, as soon as fruiting is over. Spraying should commence in the spring as soon as growth commences, and be repeated at intervals of a week or ten days for three or four applications.

Diseased Raspberry Canes.

In setting out new plantations care should be taken to obtain plants free from disease, and cut them severely back when planting to obtain a vigorous growth of new canes the first season.

Two or three fungous diseases affecting potatoes are known by the common names of Potato Rot and Potato Blight.

The Early-Blight or Leaf-Spot disease (*Macrosporium solani*) appears in summer as small, brown, brittle spots scattered over the leaves. These spots gradually enlarge, and finally run together to form large brown patches, the intermediate tissues becoming yellowish or sickly green colour. The entire plant finally withers and dies long before the proper period, the tubers being small, generally less than half full size. The tubers do not rot. The spores of this disease winter over on the dead vines. The disease is usually confined to a few plants.

The Downy Mildew or Late Blight (*Phytophthora infestans*) generally appears later in the season, and is most destructive during moist, warm weather. At such times it spreads very rapidly, often entirely destroying the plants in a few days. The tubers are also commonly affected—rotting and giving off a foul smell.

Treatment. Bordeaux mixture is a preventive of this disease, and several sprayings at short intervals should be given.

Great care should be exercised in the selection of seed tubers, the practice of planting small potatoes having apparently led to an increase of the early blight in some cases, probably from the use of seed grown from infected plants.

Tomato Rot (*Macrosporium tomato*) is reported from Armstrong and Duncan's, and known to occur in other districts. This fungous disease causes the blackish spots which form at the blossom end of the fruit and destroys the tissues, blackening the inside of the

Tomato Rot. tomato, and often rendering the fruit worthless. It can be kept in check by spraying with Bordeaux mixture, but to apply this effectively plants require to be trained to stakes and pruned to a single stem. This method also lessens the liability to attack.

Potato Scab (*Ospora scabies*) is reported from Sooke, Victoria, Ladner, and found in most parts of the Province. The fungus-producing scab in potatoes can usually be seen on partially grown tubers in the shape of fine white threads running over the

Potato Scab. surface. It reproduces by means of spores. Repeated experiments have shown that if scabby potatoes are planted a scabby crop may be expected,

and land which had produced scabby potatoes should not be planted to the same crop the following season, for the same reason. It is also noticed that scabby potatoes are more abundant in fields heavily fertilized with barn-yard manure, while crops grown on new or sod land are usually free from scab.

Good results have been obtained when only scabbed seed tubers are available, by soaking them for an hour in Bordeaux mixture before planting. The potatoes should not be cut before soaking. The selection of clean seed and new or sod land for planting are no doubt the best means of dealing with this disease.

Treatment.

Smut in grain is reported from Quamichan, Alberni, Upper Sumas, Kelowna, Lower Nicola, Bonaparte, Chilcotin, Tobacco Plains, and prevalent to a greater or less extent wherever grain is grown.

Smut in Grain. There are two kinds of smut affecting wheat, one known as "bunt, or stinking smut," in which the affected heads of grain retain a bluish-green colour for some time after the sound ones begin to ripen, and afterwards take on a bleached appearance. If injured kernels are broken open they are found to contain a mass of black powder the spores of the fungus. The other is known as "loose smut," distinguished from the preceding by the fact that the spores are not concealed. Usually, the kernels resemble masses of black powder; later this blows away, and leaves the bare chaff and stem. This and the smut affecting oats are very similar in character.

As has been stated in previous reports, one of the most common reasons for smutty grain, is the cropping of the same land year after year with the same crop. Other reasons are neglecting to change the seed used, and to use one of the well known preventives to dress seed grain.

Bluestone is probably the most-used remedy. One pound, dissolved in five quarts of water, is sufficient for four bushels of seed. It should be sprinkled over the seed, and the mass kept stirred till all is absorbed, shortly previous to the grain being sown.

The Jensen hot water method, which is so efficacious, has never come into general use, probably on account of the difficulty experienced in keeping the water at a right temperature. The following is the method referred to.

This method of treating wheat and oats as a preventive for smut was discovered by J. L. Jensen, of Denmark, in 1887, and it has since been proved that the adhering spores of smut are killed by dipping the seed in hot water without impairing the vitality of the seed. The mode of procedure is as follows:—Have two kettles of water, one heated to a temperature of from 110 to 130 degrees Fahrenheit, the other to 135 degrees Fahrenheit. The first is for the purpose of warming the seed preparatory to its being placed in the warmer water. Unless this precaution is taken it will be difficult to keep the water in the second vessel at the proper temperature. The seed to be treated should be placed in a sack that will allow the water to pass readily (a coarse gunny sack is good). According to the size of the kettles, the sack may contain from one-half to one bushel. Dip the wheat into kettle No. 1 (110 to 130 degrees), lifting it out and plunging it in two or three times. This process will occupy about two minutes. Then dip it into the warmer water, keeping the wheat in the bag well stirred. The best plan is to lift it out and plunge it in several times. This should be continued ten to fifteen minutes, according to the temperature of the water, and the grain then spread out to dry. A second person should regulate the temperature of the water, and do nothing else. Probably it will be found best to have a fire under kettle No. 2 sufficient to raise the water to 145 to 150 degrees Fahrenheit, and then add cold water to reduce it to 134 or 135 degrees Fahrenheit, when the seed is put in. If at the end of ten minutes the temperature of the water has not been reduced below 133 degrees, the seed should be removed and dipped into cold water. If below 133 degrees Fahrenheit it should be left in fifteen minutes, or even longer if the temperature should fall below 130 degrees Fahrenheit.

The treatment is essentially the same for oats, except that the temperature of the water in kettle No. 2 should be 130 or 140 degrees Fahrenheit when the oats are put in. If at the end of ten minutes the temperature is not below 135 degrees they should be left in fifteen minutes, or even longer if the temperature falls below 130 degrees. When taken out the grain should be dipped in cold water.

Oats.

Jensen or Hot Water Treatment.

Rust in grain is reported from Quamichan, Nanaimo, Steveston, and no doubt common in other sections, especially where grain is sown late, and consequently late in ripening.

Rust. The cultivation of vigorous, early ripening varieties of grain is recommended as the best method of dealing with rust, combined with proper drainage of the soil, and rotation of crops—matters too often neglected by farmers.

Mildew on peas is reported from Nicola, and common on late crops of garden peas in the lower country. The method advised for rust in grain will apply here.

SECTIONS OF ACTS AND AMENDMENTS RESPECTING THE PROVINCIAL BOARD OF HORTICULTURE.

There is hereby created a Provincial Board of Horticulture, to consist of two ex-officio members, viz., the Minister of Agriculture and the Deputy Minister of Agriculture (who shall act as Secretary of the Board), and three members, who shall be appointed by the Lieutenant Governor in Council, one from each of the horticultural districts which are hereby created, to wit:—

Creation of Board of Horticulture.

- (1.) The First District shall comprise Vancouver Island and the Islands adjacent thereto;
- (2.) The Second District shall comprise the Electoral Districts of New Westminster City, Vancouver City, Westminster, Cassiar, and that portion of Comox lying on the mainland of British Columbia;
- (3.) The Third District shall comprise the remainder of British Columbia not included in the two other districts.

The Lieutenant-Governor in Council shall appoint, from the number of the Board or from without their number, to hold office at the pleasure of the Lieutenant-Governor in Council, a competent person especially qualified by practical experience in horticulture, who shall be known as "Inspector of Fruit Pests." It shall be the duty of said Inspector to visit the horticultural districts of the Province to see that all the regulations of said Board be made known to the people of the Province, and to enforce this Act and the said regulations in the manner therein, or in this Act prescribed. The Inspector shall, from time to time, and whenever required by said Board, report to it such information as he may secure from observation, experience, and otherwise, as to the best method of diminishing and eradicating fruit pests and diseases from orchards, and also suggestions as to practical horticulture, the adoption of produce suitable to soil, climate, and markets, and such other facts and information as shall be calculated to advance the horticultural interests of the Province. The Inspector shall, from time to time, under the direction of the Board, hold meetings throughout the Province in the interests of horticulture, and impart such information and instruction to fruit-growers and farmers as may tend to the improvement and expansion of the fruit industry of the Province.

Duties.

Any member of the Board, their Inspector or agent, upon the complaint of interested parties, or upon his own motion, may inspect, or cause to be inspected, fruit, trees, plants, grafts, scions, nursery stock of all description, orchard debris, empty fruit boxes or packages, and other material, orchards, nurseries, and other places, suspected or believed to be infested with fruit pests, or infected with contagious diseases injurious to trees, plants, or fruits, and for the purposes thereof he shall have full power and authority to enter in and upon any farm, orchard, nursery, or garden, or any barn, warehouse, storehouse, shop or other place or building, and if he shall find that the said fruit, trees, plants, grafts, scions, nursery stock of all description, orchard debris, empty fruit boxes or packages, and other material, orchards, nurseries and other places are infested with fruit pests, or affected with contagious diseases injurious to trees, plants, or fruits, as aforesaid, such member, or Inspector, or agent, shall notify in writing the owner or person having charge of such premises or property, within a time to be prescribed in such notice, to treat and disinfect said premises or property in the manner presented in such notice; and such property shall not be removed after the owner or person in charge of the same shall have been notified in writing as aforesaid, without the written permission of a member of the Board or the Inspector; and if the person so notified shall neglect or refuse to treat and disinfect the said premises or property, in the manner and within the time prescribed in the said notice, such person shall be deemed guilty of a violation of this Act; and if it appears on the trial that any orchard, trees, nursery, building, or any other structures, premises or property in charge of or belonging to the defendant referred to in said notice, or any part of such structures, premises, or property, is infested or affected as aforesaid, the Court

Member of Board or Inspector to inspect.

Notify owner to disinfect.

Destruction of disinfected property. may order whatsoever of the same is so infested or affected to be disinfected or destroyed within a time to be mentioned in said order, or may make any other order that it shall deem fit : and if such order be not obeyed within the time therein specified, it shall be the duty of the Board, or of some member thereof, or of their Inspector or agent, to execute such order, and the costs and disbursements of the prosecution shall be adjudged against the party convicted as aforesaid.

(a.) In case, upon inspection as herein provided, the member of the Board, Inspector, or agent, finds any of the premises to be infested with fruit pests or affected with contagious disease, but is unable to take the proceedings herein provided by reason of there being no person in charge, or either the owner or his whereabouts being unknown, he shall be at liberty to cause the same to be disinfected, and the costs and expenses thereon shall be a lien upon the property, which may be enforced by seizure and sale of a sufficient quantity thereof to satisfy the same : Provided, however, that no property shall be destroyed under this sub-section until an order therefor has been obtained from a Justice of the Peace, which order any Justice is hereby authorised to make upon proof of the urgency of the case or of reasonable efforts having been made to ascertain the owner or person who should be in charge of the infected property.

For the purpose of preventing the spread of contagious diseases in orchards and gardens and among fruits and fruit trees, and for the prevention, treatment, cure, and extirpation of fruit pests and the diseases of fruits and fruit trees, and for the disinfection of grafts, scions, or orchard debris, empty fruit boxes or packages, and other suspected material or transportable articles dangerous to orchards, fruits and fruit trees, said Board may make regulations for the inspection and disinfection or destruction thereof, or of non-fruit-bearing trees or shrubs which may carry contagion, and also for requiring all cases of contagious diseases, or fruit pests, as aforesaid, to be reported to the Board, which regulations shall be circulated in printed form by the Board among the fruit-growers and fruit dealers of the Province, and shall be published in the British Columbia Gazette and, at the discretion of the Board, in papers of general circulation in the Province, and shall be posted in three conspicuous places in each district, one of which shall be a Court House therein ; and every such regulation, when published in the British Columbia Gazette, shall, so far as the same shall not have been in like manner repealed or varied, be deemed to be and have the force of law, and be so recognised in the Courts in the Province.

The power of inspection to include Quarantines. to make regulations for inspection shall include the power to establish and vary places and quarantine stations where such inspection shall be carried out, and to make regulations in regard to the forwarding thereto and detention thereof of articles requiring inspection :

(a.) In and by any such regulations, the Board may fix and impose any fine or penalty for the enforcement of the provisions thereof, not exceeding in amount the fines and penalties hereinafter provided in case of the evasion of any of the provisions of this Act, and may fix a scale of fees to be taken for inspection, or other services under the regulations, by officers carrying out the same from the owners or persons in possession of any premises or property :

Fines. All fines and penalties imposed or fees fixed by any such regulations may be recovered, with costs, in accordance with the provisions of the "Summary Convictions Act, 1889," and when collected shall be paid over to the Treasurer of the Board for the purposes of this Act.

Recovery thereof. All constables or other peace officers shall, when called upon by any member of the Board, or any authorised agent thereof, aid and assist such member or agent in carrying out the provisions of this Act.

Peace Officers to assist.

The powers and duties of Board extended to Hops. and duties devolving by this Act upon the said Board and the Inspector of Fruit Pests, in relation to fruit and fruit-trees, shall extend to hops and hop plants, for the purpose of preventing the spread of disease among hops and hop plants, and of extirpating any pests affecting the same.

Penalty. Every person violating the provisions of this Act shall be liable, upon summary conviction before one Justice of the Peace, to a penalty not exceeding fifty dollars.

PROVINCIAL BOARD OF HORTICULTURE.

Rules and Regulations made and published under authority of Section 7
of the "Horticultural Board Act, 1894," and of the
amendments thereto.

Title.

1. These Regulations may be cited as the "Horticultural Regulations."

Definitions.

2. In these Regulations the word "pests" shall mean and include woolly aphis, apple tree aphis, scaly bark louse, oyster-shell bark louse, San Jose scale, red scale, borers, codlin moths, currant worms, caterpillars, or other known injurious insects, and all fungous diseases. The "Board" shall mean the Provincial Board of Horticulture.

Notification of the Presence of Pests.

3. All nurserymen, fruit-growers, and all persons owning, occupying or managing an orchard, garden or nursery infected with any pest, shall notify the member of the Board for the district in which such orchard, garden or nursery is located, or the Secretary or Inspector, or the agent of the Board in the district, of the fact that such orchard, garden or nursery is so infected.

Inspection of Nursery Stock.

4. All importers of nursery stock, trees or plants must give notice to a member of the Board, or his agent, or the Inspector of Fruit Pests, upon the arrival of any nursery stock, trees or plants, before the removal of such nursery stock, trees, or plants from any dock, wharf, mole, station, or warehouse where such nursery stock, trees, or plants have been landed, and if such nursery stock, trees or plants are found to be free of insect pests and fungous diseases, the said member of the Board, his agent, or the Inspector of Fruit Pests, shall issue a certificate to that effect; and all such nursery stock, trees or plants, if found to be infected with any insect pest or fungous disease, shall be dealt with according to the Rules and Regulations of the Board. All dealers, nurserymen, or persons selling or distributing nursery stock, trees, or plants for which no clean certificate is in force shall, before distributing or offering for sale any article above mentioned, notify the member of the Board, his agent or representative, in whose district any such article is found, or the Secretary of the Board, or the Inspector of Fruit Pests, who shall inspect or cause to be inspected such nursery stock, trees, or plants, and if they are found to be free from pests shall issue a certificate to the owner or person in charge, stating that said articles appear to be free from pests. Such certificate shall be in force for three months from date of issue, unless revoked by further inspection.

Disinfection of Nursery Stock, Trees and Plants.

5. All persons owning or having in their possession nursery stock, or trees and plants of any kind, infected with insect pests of fungous disease, shall cause the same to be disinfected and cleansed by using the remedies herein prescribed, or such other insecticides and fungicides as may be found effective, and are approved of by a member of the Board or the Inspector of Fruit Pests, and no such infected nursery stock, trees, or plants shall be sold, forwarded, distributed, or parted with until a certificate of the satisfactory cleansing thereof shall have been obtained from a member of the Board or his agent, or the Inspector of Fruit Pests. Any member of the Board or the Inspector of Fruit Pests may order the destruction, by rooting out and burning, all infected nursery stock, trees, or plants of any kind, if, in the opinion of such member of the Board or Inspector of Fruit Pests, such a course is considered expedient in the interest of the fruit-growing industry.

Inspection of Imported Fruit.

6. All importers of fruit must give notice to a member of the Board or his agent, or the Inspector of Fruit Pests, upon the arrival of any and all shipments of fruit; and all fruit and fruit packages imported into this Province shall be inspected, and if found to be free from insect pests and fungous disease a clean certificate shall be issued therefor in conformity with the Rules and Regulations of the Board: Provided, however, that no fruit or fruit packages imported into this Province shall be removed from any dock, wharf, mole, or station where such fruit and fruit packages have been landed, before inspection and such clean certificate thereof shall have been obtained, and all such fruit and fruit packages as may be found infected with any insect pest or fungous disease shall be either destroyed by the importers thereof, by such process and within such time as any member of the Board, the Inspector of Fruit Pests, or any agent appointed by the Board, may direct, or shall be re-shipped, within such time as any member of the Board, the Inspector of Fruit Pests, or any agent appointed by the Board, may direct, by the importers thereof to some point without the Province.

Inspection of Imported and Home-grown Fruit.

7. All fruit, whether imported or grown in this Province, or exposed for sale, shall be subject to inspection under the authority of the Board, and if found to be infected with any injurious insect pest or fungous disease shall be quarantined, or may be destroyed at the expense of the owner of said fruit, by such methods as the Board or its agents may direct.

Stencilling and Labelling.

8. All persons shipping, sending, or delivering any fruit, fruit trees, scions, cuttings, or plants within the Province shall place upon or securely attach to each box, crate, or other package or parcel containing the same, a distinct stamp, mark, or label showing the name of the producer and shipper or sender, and the locality where grown, but boxes and barrels containing fruit shall be stencilled or stamped with letters not less than three-quarters of an inch in length.

Treatment of Nursery Stock.

9. All infected nursery stock shall, before being distributed, be disinfected by dipping in a solution of one pound caustic soda (concentrated lye) and one pound whale-oil soap to every five imperial gallons of water, thoroughly dissolved, and applied at 103° Fahrenheit in a vat or any suitable vessel, or the said nursery stock may be disinfected by covering with an air-tight tent or box, and for each and every 100 cubic feet of space therein one ounce of fused cyanide of potassium (58 per cent.), one fluid ounce of sulphuric acid, and two fluid ounces of water shall be used. The cyanide of potassium shall be placed in an earthenware vessel, the water poured over the said cyanide of potassium, afterwards adding sulphuric acid, and the tent or box to be immediately closed tightly and allowed to remain closed for not less than forty minutes. Treatment for disinfection shall continue until all insect pests or their larva are destroyed.

10. (*For sprays see preceding pages, 5, 6, 7, 8, and 9.*)

11. Where pests or fungous diseases are found to exist during the growing season, while the trees are in leaf, spraying must be done and such remedies applied as shall be recommended by or under authority of the Board from time to time, so that the insects or diseases can at least be held in check until the stronger washes of the dormant season can be safely applied.

Destruction of Packages.

12. All boxes, crates or other packages or wrappings which have contained infected nursery stock shall be destroyed by fire immediately after the removal of the contents thereof.

Hop-fields.

13. Where hop-fields are infected with the hop-louse, spraying must be done as the Board from time to time shall recommend.

Inspection at points other than Quarantine Stations.

14. Importers or owners of nursery stock, trees or plants, desiring to have such nursery stock, trees or plants inspected at points other than regular quarantine stations, may have such inspection done where required: Provided, however, that such importers or owners shall pay all charges of inspection and expenses of the officer employed in such inspection. Such charges and expenses to be paid before a certificate is granted.

Quarantine Regulations.

15. STATIONS.

QUARANTINE OFFICERS.

Victoria	{ The Inspector of Fruit Pests, any member of the Board, and E. A. Carew-Gibson.
Vancouver, New Westminster and Liverpool	{ T. Cunningham, any other member of the Board, and the Inspector of Fruit Pests.
Nanaimo	{ Geo. Pannell, any member of the Board, and the Inspector of Fruit Pests.
Comox	{ George H. Roe, any member of the Board, and the Inspector of Fruit Pests.
Mission City	{ G. W. Henry, any member of the Board, and the Inspector of Fruit Pests.
Vernon	{ Herbert Francis Denison, any member of the Board, and the Inspector of Fruit Pests.
Osoyoos	{ C. A. R. Lambly, any member of the Board, and the Inspector of Fruit Pests.
Kettle River	{ R. R. Gilpin, any member of the Board, and the Inspector of Fruit Pests.
Golden	{ E. C. Lang, any member of the Board, and the Inspector of Fruit Pests.
Fort Steele	{ R. L. T. Galbraith, any member of the Board, and the Inspector of Fruit Pests.
West Kootenay	{ John F. Costello, Northport, any member of the Board, and the Inspector of Fruit Pests.

Transportation companies or persons shall deliver and cause to be detained all nursery stock, trees, plants and fruit, at one or other of the quarantine stations for inspection, as provided by the Rules and Regulations of the Board, and all such nursery stock, trees, plants and fruit shall not be removed without the consent of the quarantine officer having been first obtained.

A quarantine officer may also, if in his opinion such a course is necessary, detain any nursery stock, trees or plants, for the purpose of disinfection, at a quarantine station, until such quarantine officer is satisfied that all infection is removed: Provided, however, that in no case shall the inspection of nursery stock, trees, plants and fruit be done by a quarantine officer having any pecuniary interest in the same.

Inspection Fees.

16. The fees for inspection of apple, pear, plum, cherry and other fruit trees, shall be as follows:—

On all consignments numbering—

Under 100 trees	\$2 50
100 trees and under 250	3 50
250 " " 500	4 50

And for every additional 500 trees or fraction thereof over 500, \$1 additional.

For other nursery stock the fees shall be as follows:

\$2.50 on \$25.00 in value or fraction thereof.
 \$3.50 on any consignment over \$25.00 and up to \$50.00 in value; and 5 per cent. additional on the value over \$50.00.

When nursery stock, trees or plants are found to be infected with insect pests or diseases, a charge of 50 per cent will be added to the foregoing rates, to pay expenses of the quarantine officers for supervising, disinfection, and subsequent inspections.

On fruit, viz. :—

Apples, pears and quinces, the minimum fee shall be \$1.00 on any sum up to \$33.00, and 3 per cent. on any sum over \$33.00 in value.

It is furthermore provided that all other varieties of fruit shall be subject to inspection, if deemed necessary, on the same terms, and subject to the same fees as those above mentioned.

Certified invoices will be required.

Penalties.

17. Every person violating the provisions of the "Horticultural Board Act, 1894," or any amendments thereto, or the Rules and Regulations adopted by the Board, is liable, upon summary conviction before a Justice of the Peace, to a penalty not exceeding fifty dollars for each offence.

Repealing former Rules and Regulations.

18. All Rules and Regulations heretofore adopted and published under the authority of the "Horticultural Board Act," or any amendments thereto, are hereby repealed, and the foregoing Rules and Regulations substituted in lieu thereof.

Recommendations.

Horticultural and Agricultural Societies, and all those interested in advancing and protecting the interests of fruit-growing, are requested to co-operate with the Board in the enforcement of the provisions of the "Horticultural Act," and the regulations thereunder, as adopted by the Board.

Correspondence.

All correspondence relating to the extirpation of fruit pests should be addressed to the Inspector of Fruit Pests, or the member of the Board whose district may be affected. Correspondence relating to other matters should be addressed to the Secretary of the Board.

By Command,

J. R. ANDERSON,

Secretary.

Office of the Provincial Board of Horticulture,

Victoria, 25th June, 1897.

MEMBERS OF THE BOARD.

The Honourable the Minister of Agriculture.

Jas. R. Anderson, Deputy Minister of Agriculture.

R. M. Palmer, Inspector of Fruit Pests, of Victoria, to represent the First Horticultural District, which comprises Vancouver Island and the islands adjacent thereto.

Thomas Cunningham, of New Westminster, to represent the Second Horticultural District, which comprises the Electoral Districts of New Westminster City, Vancouver City, Westminster, Cassiar, and that portion of Comox lying on the Mainland of British Columbia.

Thomas G. Earl, of Lytton, to represent the Third Horticultural District, which comprises the remainder of British Columbia not included in the two other districts.

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